

# AFC 1500 Multi Unit Hardware Manual



**Version 2.04**  
**(Compatible with AFC User Console Software Version 3.61 and above)**  
**April 2003**



51327 Quadrate Drive Macomb, MI. 48042  
Ph. 586.781.2100 Fax 586.781.0044  
[www.fec-usa.com](http://www.fec-usa.com)

## **\*\*\* WARNING \*\*\***

All applicable National and local codes must be followed when installing and operating the equipment detailed in this manual.

**FAILURE TO ABIDE BY THESE CODES AND THE SPECIFICATIONS DESCRIBED IN THIS MANUAL CAN RESULT IN SERIOUS INJURY TO PERSONNEL AND/OR DAMAGE TO THE EQUIPMENT.**

### **\*\*\* WARNING \*\*\***

- \*\* THIS EQUIPMENT IS CAPABLE OF HIGH VOLTAGES HAZARDOUS TO HUMAN LIFE.
- \*\* Turn off and lock-out all voltage sources prior to performing any work on this equipment.
- \*\* Do not open or remove any covers, even if the Unit is disconnected from the power source.
- \*\* Only qualified personnel should attempt to modify or repair this product.
- \*\* There is a possibility of receiving an electrical shock from this equipment, if used improperly.
- \*\* This System is designed to operate on 200 VAC. Injury or damage could result from using improper voltage.

### **OPERATOR AND EQUIPMENT SAFETY**

- \*\* Read this manual carefully before attempting to operate the equipment.
- \*\* If this System is being operated as a part of a larger system, the larger system should be clearly marked with the warning information, above. Also, a copy of this notice should be included in all pertinent operations and maintenance manuals. At a minimum, Controller
- \*\* Units must be placed in a NEMA 12 / IP52 enclosure. Some type of Air Handling Unit (air conditioner, heat exchanger, etc.) may also be required.
- \*\* Be sure to use the recommended circuit breakers with the power supply lines.
- \*\* Use the power supply voltages recommended in the specifications to prevent possible personnel injury and equipment damage.
- \*\* Do not modify this equipment, or the warranty will be void. Please contact FEC INC. if any special modification is required.
- \*\* Inspect the equipment for wear and damage at regular intervals.
- \*\* Specific precautions regarding equipment installation and location have been incorporated into this manual. Before operating the equipment, verify that countermeasures have been taken for any adverse conditions that may exist.
- \*\* Failure to address these conditions prior to operation could result in damage to the equipment.

Any questions regarding the contents of this document or any related matter should be directed to FEC INC. at (586) 781-2100. Requests may be faxed to FEC INC. Product Engineering at (586) 781-0044.

Unauthorized reproduction or distribution of this manual is strictly prohibited. Please contact FEC INC. if you require additional copies.

# Table of Contents

## Table of Contents

### Multi Unit Outline

#### Functions Outline

Sequence Control	8
Parameter Programming	8
Fastening Data Monitoring & Communication	8
General Status Indication	9

#### Specifications

#### Installation Requirements

Installation Environment	10
Static Electricity	10
Cleaning	10
Handling and Shipping	10

#### Unit Description

Basic Dimensions	12
Description of Unit	13

## Setup and Wiring

#### Multi Unit Installation

Power Input	16
Power wiring reference	17

#### Multi Unit connection

RS485 Communication Port	18
RS485 port connection	19
Serial Communication Ports	20
Output Data Available	22
Data Output Example	23

# Control Interfaces

	25
<b>Interface Board Setup</b>	26
<b>Discrete I/O Interface</b>	28
Input/Output Signals	29
Input Signals (Connector PLC1)	29
Output Signals (Connector PLC2)	30
Bank Select Outputs	30
Discrete Signal Connection	31
Standard I/O Cable - Wire Color Code	32
<b>InterBus S Interface Board</b>	33
Indication LED	34
Termination	35
<b>DeviceNet Interface board</b>	36
Termination	37
EDS File	38
Indication LED	38
<b>Profibus Interface Board</b>	39
Termination	40
GSD File	40
Indication LED	41
Node Address	41
Configuration	41
<b>Mitsubishi CC-Link</b>	42
Termination	43
Indication LED	45
Configuration	45
<b>Allen Bradley Remote I/O Interface board</b>	46
Termination	47
Indication LED	48
<b>Fieldbus I/O Assignment</b>	49
<b>ANYBUS-S Reference</b>	50
AnyBus S Initialization	50

<b>AnyBus - DT Reference</b>	51
AnyBus DT Initialization	51
<b>Input / Output Signals &amp; Fastening Data Outline</b>	53
<b>Multi Unit Input Signals</b>	54
Sequence Select Table	55
<b>Multi Unit Output Signals</b>	56
Bank Select Procedure	56
Multi Unit Output signals	57
<b>Signal Timing</b>	58
Sequence Select Timing	59
<b>Output signals from the SAN Servo Controllers</b>	60
<b>Typical I/O Layout</b>	61
<b>Abnormal Code</b>	63

(This page intentionally left blank)

# Multi Unit Outline

The Multi Unit is a complementary device to enhance the AFC1500 capabilities by providing the communication and the sequence control features required by larger or more sophisticated multi spindle applications.

## In this chapter

- Functions Outline
- Specifications
- Installation requirements
- Unit Description

## Functions Outline

The Multi Unit is a complimentary controller device to enhance the AFC1500 capabilities by providing the communication and the sequence control features required by larger or more sophisticated multi spindle applications. When a group of AFC1500 Servo Controllers (SAN Units) are linked to a Multi Unit, the Multi Unit assumes control (over these spindles) of the following functions:

- Sequence Control
- Parameter Programming
- Fastening Data Monitoring & Communication
- General Status Indication

### Sequence Control

The Multi Unit assumes control of the control signals (e.g.: STOP, START, REVERSE, BYPASS, etc.) to all of the AFC1500 Servo Controllers linked to it via the RS485 communication port, thus eliminating direct connection & control to the individual spindles. The control signals for the multi-spindle array can be of different sources: Signals manually generated by pressing the Control Buttons on the front of the Multi Unit or I/O (Input/Output) signals from a PLC or from a PC Based Controller.

Also the Multi Unit controls the fastening sequencing eliminating the need for external control devices (PLC) to perform complicated control sequencing. All fastening sequencing is handled by the Multi Unit. This built in feature allows the Multi Unit to control a variety of complex sequencing strategies including; spindle grouping within the same application, several fastening steps, reject (reversing) strategies, wait timing, multiple starts, etc.

### Parameter Programming

A Windows® compatible computer running the AFC User Console software package can be connected to the Multi Unit in order to upload or download the preset data to all the SAN (Servo) Controllers connected in the multi spindle array. This eliminates the need to program individual spindles manually.

### Fastening Data Monitoring & Communication

The Multi Unit can monitor and process the fastening results collected from the AFC1500 Servo (SAN) Controllers connected to it. It has three (3) configurable RS232C ports to input and output fastening data results. Data monitoring / saving is also a function of the AFC User Console software package.

As an added feature, the Multi Unit stores previous fastening data in RAM (volatile) for uploading at another time. The number of cycles stored is based on the number of spindles connected and is as follows; 1 Spdl. = 1817 cycles, 7 Spdls. = 641 Cycles, 10 Spdls. = 479 cycles, 20 Spdls. = 263 cycles, 31 Spdls. = 173 cycles.

The number of cycles stored will be reduced if RS232 COM2 data is stored with the fastening data. The data can be uploaded using the AFC User Console software package.

## General Status Indication

A set of indicator LED's provide the status for Total Accept, Total Reject, Abnormal, Busy and Power on conditions.

## Specifications

The Multi Unit has the following specifications:

Multi Unit Operation Specifications	
Power Supply Voltage	100 to 220 VAC $\pm$ 15%, 1-phase, 50/60 Hz.
Power Consumption	30 Watt Maximum
Operating Current	Less than 70 ma
In rush current	Less than 160 ma
CPU	NEC V53A
Data Communication	RS232C COM1 (Data output)
	RS232C COM2 (Input port)
	RS232C (Reserved for future use)
	RS485 Channel 1 Servo Units Programming
	RS485 Channel 2 Servo Units Control
Control Interfaces	Discrete I/O (24Vdc Sink)
	DeviceNet
	Interbus-S
	Profibus
	Mitsubishi CC Link*
	Allen Bradley Remote I/O * (Lic. #199906006)
	<b>Also Available:</b>
	Modbus Plus
	CANopen
	ControlNet
	Ethernet 10/100 (Modbus)
	LonWorks
Fastening Sequence Programming Steps	100
Fastening Control Methods	Torque Control / Angle Control
Maximum number of spindles	31 per Multi
Fastening Parameters	16
Fastening Sequences	16
Torque Rate monitoring areas	3 (1st, 2nd, and 3rd Rate)
Installation requirement	NEMA12 Enclosure
Operation Temperature	0° to 50 °C (32 ° to 122 °F)
Operation Humidity	20% to 90%

\* Mitsubishi CC Link & Allen Bradley Remote I/O are proprietary and licensed for use.

# Installation Requirements

## Installation Environment

Do not use at the following locations: (If these conditions cannot be achieved, contact FEC INC.)

- Areas under direct sunlight.
- Areas where the environmental temperature is out of the 32°F-122°F (0° to 50 °C) range.
- Areas where the relative humidity is out of the 20-90% range.
- Areas where the temperature changes quickly, which may cause moisture.
- Areas where conductive powder, oil mist, saline, or organic solvents exist.
- Areas that have corrosive or combustible gases.
- Areas that have strong electric or magnetic fields.
- Areas where a strong vibration or shock could be transmitted directly to the Unit.
- Multi Units must be located a minimum of 600 mm from sources of high transient voltage such as transformers, AC inverters, AC contactors and motor starters. If this cannot be avoided, then the unit must be properly shielded.

## Static Electricity

The Multi Unit construction incorporates many electronic Surface Mounted Devices (SMD). Use standard grounding & safety practices to avoid possible electrostatic discharge to the unit.

## Cleaning

Do not use any organic solvents, such as thinner, to clean a Multi Unit. The solvent could penetrate inside and damage the circuitry. A cloth dampened with alcohol or warm water should be used to lightly wipe the components.

## Handling and Shipping

It is critical that the Multi Unit be properly handled and shipped in order to maintain its integrity. If unit is to be shipped in an enclosure, tighten both mounting screws to prevent unit from becoming dislodged. If unit is to be shipped loose, pack it in an anti-static container or wrap it to prevent damage from electrostatic discharge. Pack & ship to avoid damage from dropping / shock.

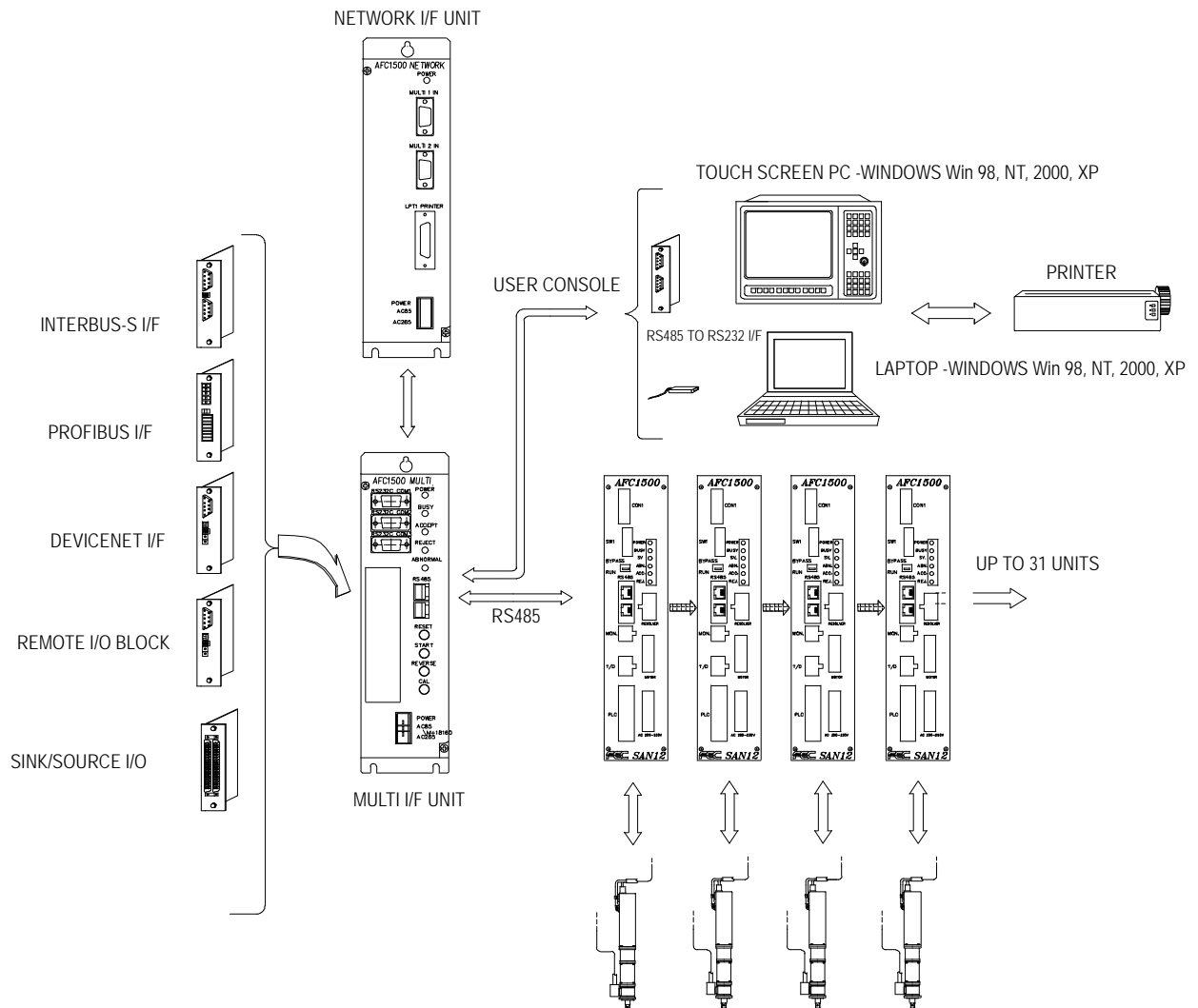
Avoid shipping conditions or storage areas where the room temperature is out the -5 ° to 55 °C (23 ° to 131°F) range and the humidity is above 90%.

# Unit Description

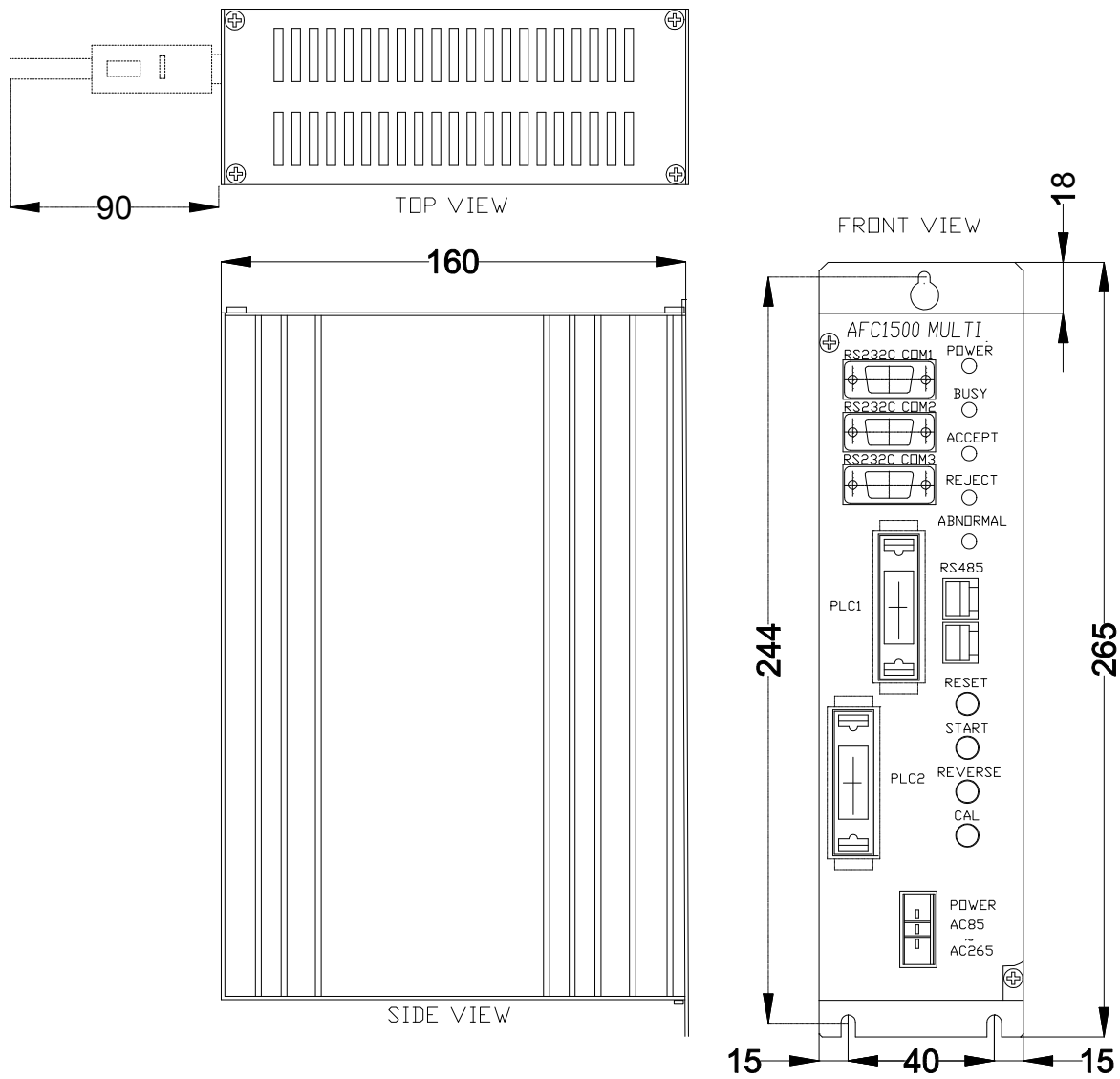
## Connection Configuration

The following figure shows how the Multi Unit is connected in a multi spindle configuration.

The figure depicts the connection configuration for the AFC1500 Servo (SAN) Units, the User Console and the various interface devices to the Multi Unit.

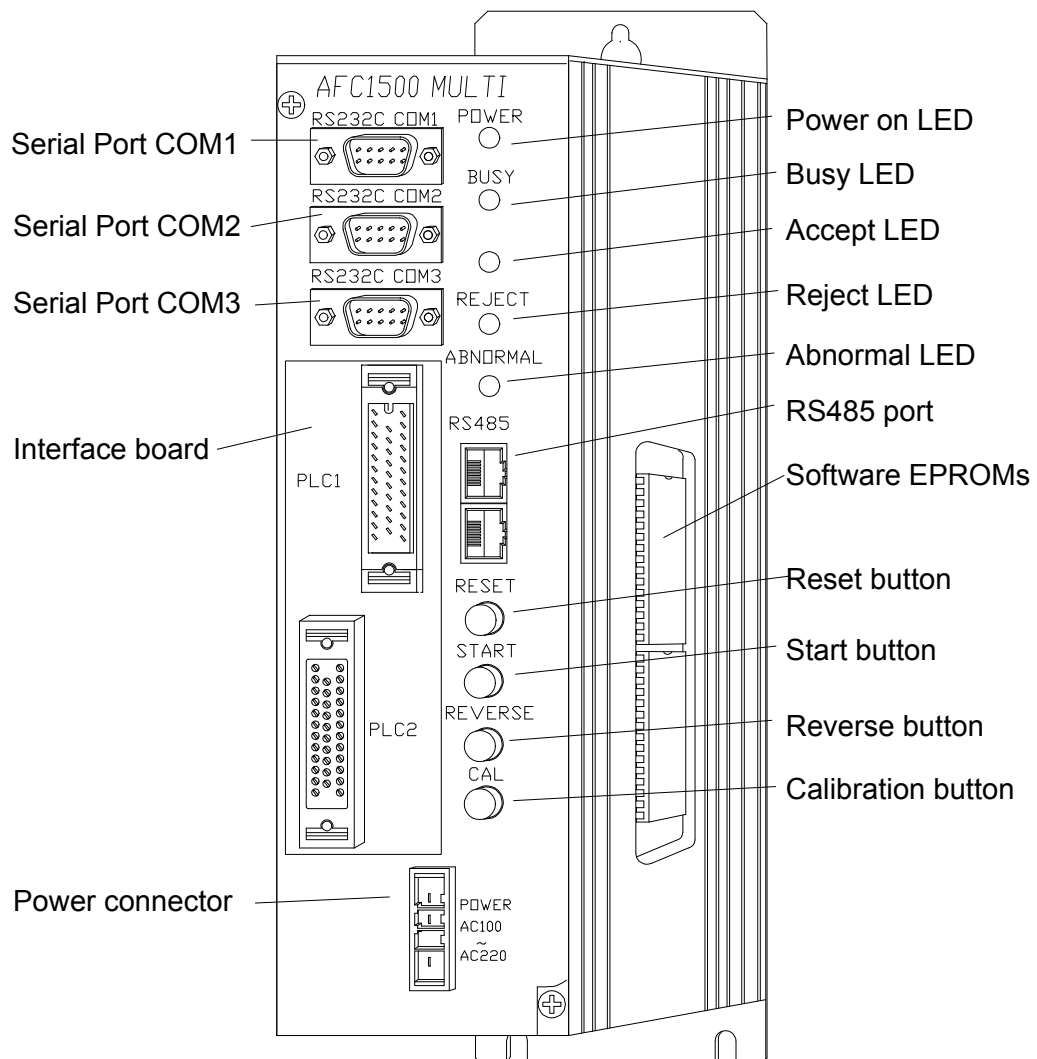


## Basic Dimensions



Shown with Discrete I/O board

## Description of Unit



Multi Unit Panel Description	
Power On LED	Indicates when power is applied to the Multi Unit.
Busy LED	Lights when the unit is performing a self check, reverse, fastening operation or is downloading/uploading data to the AFC User Console software package.
Accept LED	Lights if a fastening cycle or a self check test falls within acceptable parameters. (This LED indicates status for ALL connected spindles)
Reject LED	Lights if a fastening cycle or a self check test is outside of acceptable parameters. (This LED indicates status for ALL connected spindles)
Abnormal LED	Lights when a system abnormal condition is detected in the control system of any connected spindles. (Does NOT indicate a fastening reject). All operations are halted and cannot be restarted until the Abnormal condition is corrected. Can be cleared only by the Reset function. (see AFC1500 Fastening System Manual for Abnormal Troubleshooting)

Multi Unit Panel Description	
RS485 Port	RJ45 style connector used to connect to all AFC1500 Servo (SAN) Units included in the system, and also the User Console. Two (2) proprietary communication channels CH1 & CH2 are accessed using this port.
Reset Button	Resets all signal and communication buffers to “clear” conditions. Clears the Abnormal signal and performs the Torque Transducer Zero Level Check.
Start Button	Starts the fastening cycle. Requires a pulse of 0.1 to 0.5 sec. for “Normal” start selection or must be maintained during complete cycle for “Deadman” start selection.
Reverse Button	Turns the spindles in the opposite direction of the preset fastening direction while the button is held active.
Cal Button	Performs the Torque transducer shunt calibration test. When depressed, the Servo (SAN) Units will display either a green accept LED or red reject LED indicating status of the individual Calibration test.
Power Connector	Connects to incoming power : 100 to 220VAC (auto-sensing), Single phase, 50/60 Hz.
Interface Board (I/O)	Allocation socket for input/output signal Interface boards. Options available are Discrete I/O, Interbus-S, DeviceNet, Profibus, CClink, or Allen Bradley Remote I/O (Rockwell License #199906006)
Serial Port COM1 (Output)	Communication port for fastening result data output to any external device, i.e.: host computer, serial printer, Network Unit, etc. Data output format is configured using the User Console (AFC) Software package.
Serial Port COM2 (Input)	Communication port for ASCII data input from peripheral devices. ( ex. bar code readers, RF tag, etc.) Allows external ASCII data to be merged with Fastening result data.
Serial Port COM3	Reserved for external remote data Display

# Setup and Wiring

2

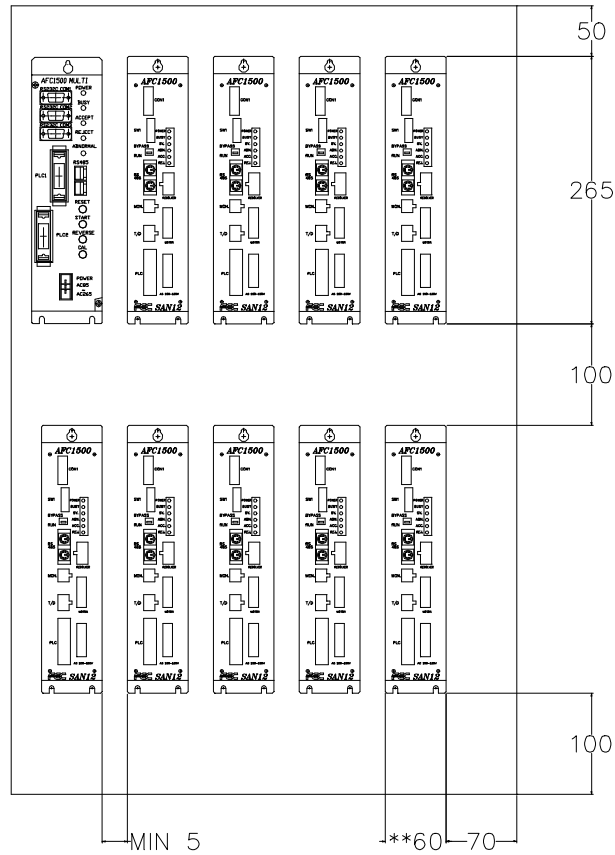
**This chapter describes the Multi Unit mounting requirements and all wiring connection references including communication port specifications.**

## **In this chapter**

- **Installation**
- **Connection**

## Multi Unit Installation

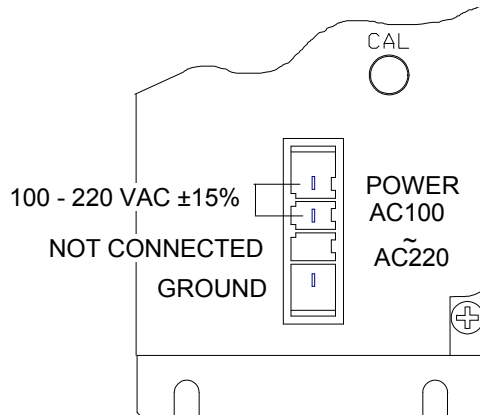
The Multi Unit should be mounted into a NEMA12 / IP52 enclosure at a minimum and spaced similar to the 1500 SAN Units (Shown Below).



\*\* FOR SAN40 MODULES CONSIDER 74 MM WIDTH

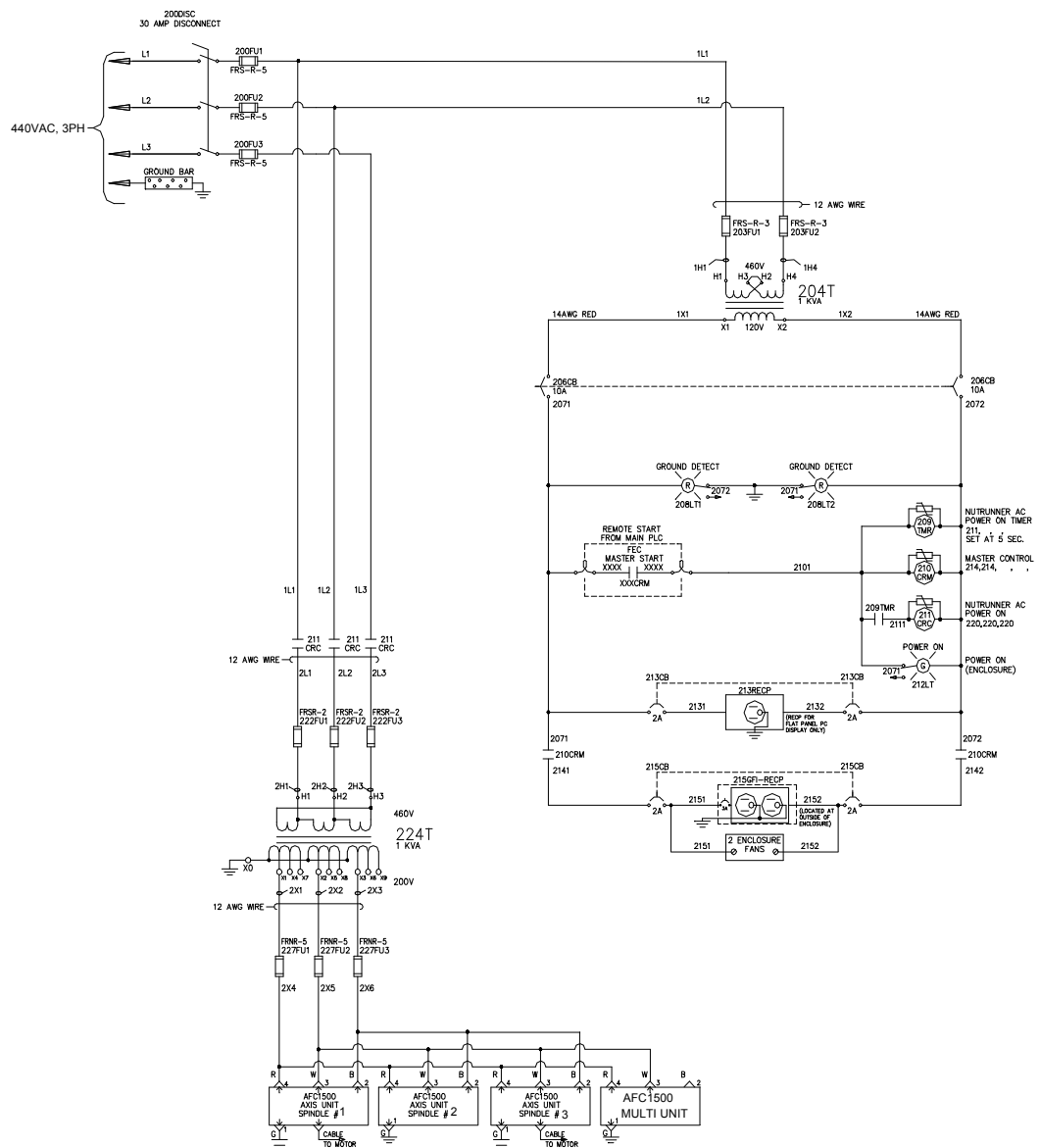
## Power Input

An auto sensing power supply allows for input power in the range of 100 - 220VAC single phase, 50/60 hertz.



## Power wiring reference

Even though the Multi Unit power input allows it to connect to 120 VAC- 220 VAC power lines, typically the unit is connected to the same power source that the SAN Units are connected to. (200 to 220 VAC  $\pm$  10%) . In the example wiring diagram shown below there are two power branches: one is for the control circuitry connected to 120 VAC and the other is for the SAN power circuitry, connected to 220 VAC. For convenience, the Multi Unit is wired together with the AFC1500 Servo Controllers. Note that the Multi Unit is using one phase while the Servo Controllers use three phases.

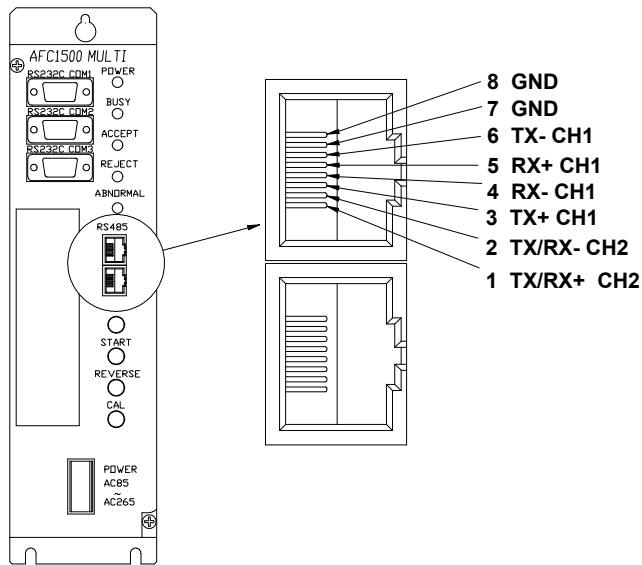


# Multi Unit connection

## RS485 Communication Port

The Multi Unit uses an RS485 port to perform the communication operations with both the AFC1500 Servo (SAN) Controllers and the AFC User Console (computer). Two RJ45 connectors are provided. Both connectors are internally jumpered in parallel. Each port has two channels CH1 and CH2. CH1 is dedicated to handle the communication with the User Console, that is to say, all preset data upload and download, fastening results monitoring and collection.

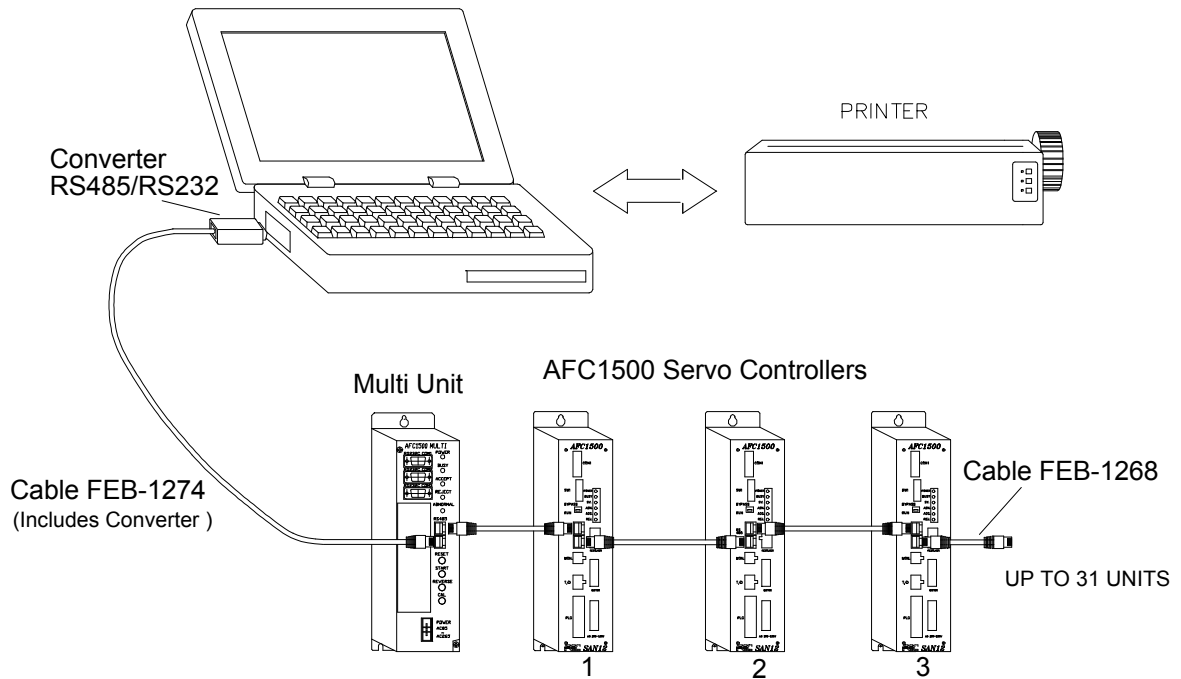
Channel CH2 is a high speed connection to all AFC1500 Servo Controllers. It controls all required commands to perform the fastening cycle.



RS485 CH1 port specifications	
Speed	9600 OR 38,400 baud
Cable	Std Cat 5 Ethernet
Maximum number of connected devices	31
Protocol	Proprietary
Operating Voltage	RS485 Standard

RS485 CH2 port specifications	
Speed	Up to 500K baud
Cable	Std Cat 5 Ethernet
Protocol	Proprietary
Operating Voltage	RS485 Standard

## RS485 port connection



**Note:** Many laptop computers have external RS232 serial ports which require converters to change to RS485 to connect to the Multi Unit. When using a self powered RS485/RS232 converter (Telebyte #253-PP2 [www.telebyteusa.com](http://www.telebyteusa.com)), communication errors may occur due to the loss of power during communication to large numbers of spindles. In this case, use a powered converter or direct RS485 communication.

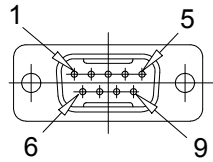
If your laptop does not have a RS232 card, it is recommended that a PCMCIA Serial RS232 or RS485 card be used. (ie. [www.socketcom.com](http://www.socketcom.com))

**We do not** recommend USB RS232 converters. Many of these converters in the market will not operate correctly using this system.

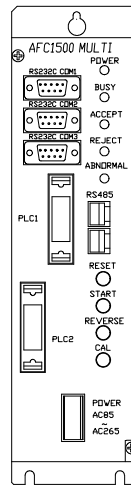
**Note:** In order for the Multi Unit to communicate properly to the SAN (Servo) Units, the spindle(s) address DIP Switch must be set correctly. No two units may share the same address, however, unit addresses may be skipped or started from a number besides #1. If units are skipped, the missing spindle addresses MUST be removed from the programmed fastening sequence or an abnormal will result. (See AFC1500 Operations Manual Section 4.10 for Address setting information)

## Serial Communication Ports

The Multi Unit has three serial RS232C communication ports. All of these port settings and data are fully configurable with the AFC User Console software. COM1 is an output port for ASCII fastening data communication to external devices. The COM2 port is for inputting ASCII data to the fastening system for marriage to the fastening data. It is typically used for attaching part serial number(s) to the fastening data for data storage birth history. COM3 is reserved for a remote data display. The data format for these ports are configurable using the AFC User Console software package.



PIN #	SIGNAL NAME
1	DCD
2	RXD
3	TXD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	NOT USED



RS232C Pin Layout		
1	DCD Data Carrier Detect	Used only for Com 2 (input)*
2	RXD Receive Data	Serial Data Input.
3	TXD Transmit Data	Serial Data Output.
4	DTR Data Terminal Ready	Output signal; active when the internal device is ready to link.
5	GND Ground Signal	
6	DSR Data Set Ready	Input signal; indicates that the external device is ready to establish a link. Can be connected directly to DTR for automatic data dump.
7	RTS Request to Send	Output signal. active when the internal device is ready to exchange data.
8	CTS Clear to Send	Input signal; indicates that the external device is ready to exchange data. Can be connected directly to RTS when no asynchronous data flow is required.
9	RI Ring Indicator	Not used

\*When using Com2 (input) - Pin 1 DCD must be enabled for data input.(Jumper pins 1 & 4)

<b>RS232C COM1 port specifications (OUTPUT DATA)</b>	
Speed	Configurable (1200, 2400, 4800, 9600, 19,200)
Data bit	Configurable (7 or 8)
Stop bits	Configurable (1 or 2)
Parity	Configurable (none, even or odd)
Data Output format	Configurable (ASCII or PLC format <sup>1</sup> )

<b>RS232C COM2 port specifications (INPUT DATA)</b>	
Speed	Configurable (1200, 2400, 4800, 9600, 19,200)
Data bit	Configurable (7 or 8)
Stop bits	Configurable (1 or 2)
Parity	Configurable (none, even or odd)
Data Input format	Configurable (ASCII format)

<b>RS232C COM3 port specifications</b>	
Reserved for remote data display	

---

<sup>1</sup> PLC format adds STX (beginning of data) and ETX (end of data) control characters

## Output Data Available

The Multi Unit is capable of outputting the fastening results data in an ASCII format to a serial printer or other peripheral device. The data is sent from the Multi Units RS232 COM1 port. The output data string as well as port configuration can be configured by the AFC User Console Software. (Control Characters may also be implemented ie; Start of Text, End of Text, etc.)

Below is a list of data available and its byte length.

Basic Fastening Data		Length in bytes
Peak Torque		6
Final Angle		5
First Time		6
Final Time		6
Cycle Time		5
First Torque Rate		7
Second Torque Rate		7
Third Torque Rate		7
Final Torque		5
Offset Torque		5
Judgement		3
Extended Fastening Data		Length in bytes
Current (@ peak torque)		4
Angle (@ peak torque)		4
First Peak Torque		5
Second Peak Torque		5
First Torque Rate Increment Torque		5
First Torque Rate Increment Angle		4
Second Torque Rate Increment Torque		5
Second Torque Rate Increment Angle		4
Third Torque Rate Increment Torque		5
Third Torque Rate Increment Angle		4
Rundown revolutions		4
Cal Voltage Value		5
Zero Voltage Value		5
Input Data*		Length in bytes
RS232C data 1	Up to 128 This length is determined by the user and dependent upon the length of data input to these data areas.	
RS232C data 2		
RS232C data 3		
RS232C data 4		
System Data		Length in bytes
Date		10
Time		8
Spindle Number		2
Sequence Number		2
Parameter Number		2
Cycle Count Number		7
Retry Flag		3 (ASCII “RTY”)

\*Input Data is input to the Multi Unit using RS232C Com2 port. This port configuration is through the AFC User Console Software. The data must be ASCII formatted data & is limited to 128 bytes in (4) separate data buffers. The port must be configured for the input string which is to be received. The data received can then be married with the resultant fastening data by selecting the RS232 data in the output format. This function is typically used to marry a part number with the resultant fastening data for production birth history.

## Data Output Example

The example below shows the format of the COM1 output connected to a printer. Actual data output format may vary depending on the configuration and set-up of this port using the AFC User Console Software. The data field is selectable from all the available output fields to as little as one output field. (See previous table for available data fields) Headers, Footers & ASCII control characters are all configurable using the AFC User Console Software.

2002/09/26 09:17:57 SEQ01	
SP PA TORQUE ANGLE 1RATE 2RATE OFFSET JUG	<u>Acceptable Fastening</u>
01 01 0.50 2 0.000 0.005 0.00 O	
2002/09/26 09:19:36 SEQ01	
SP PA TORQUE ANGLE 1RATE 2RATE OFFSET JUG	<u>Rejected Fastening</u>
01 01 0.17L 0 0.000 0.000 0.00 X	
2002/09/26 09:21:16 SEQ01	
SP PA TORQUE ANGLE 1RATE 2RATE OFFSET JUG	<u>Reset Cycle</u>
01 01 0.23L 0 0.000 0.000 0.00 !	(Before fastening end)
2002/09/26 09:21:21 SEQ01	
SP PA TORQUE ANGLE 1RATE 2RATE OFFSET JUG	<u>Cycle Stopped</u>
01 01 0.17L 0 0.000 0.000 0.00 !	(Before fastening end)
2002/09/26 09:21:34 SEQ01	
SP PA TORQUE ANGLE 1RATE 2RATE OFFSET JUG	<u>Abnormal</u>
01 01 0.01 0 0.000 0.000 0.00 A05	(Showing abnormal code)
2002/09/26 09:21:21 SEQ01	
SP PA TORQUE ANGLE 1RATE 2RATE OFFSET JUG	<u>Spindle Bypassed</u>
01 00 0. 0. 0. 0. 0.	

### Index

**SEQ:** Sequence

**SP:** Spindle

**PA:** Parameter

**ANGLE:** Final Angle

**1RATE:** 1st Rate

**2RATE:** 2nd Rate

**OFFSET:** Offset Torque

**JUG:** Judgment

**H:** High

**L:** Low

(This page left intentionally blank)

# Control Interfaces

## 3

The Multi Unit has integrated a modular I/O

Interface to accommodate the use of fieldbus I/O

as well as discrete I/O making the unit

adaptable to changing I/O structures.

### In this chapter

- Interface Board Setup
- Discrete I/O (24VDC)
- InterBus S
- DeviceNet
- Profibus
- CC Link
- Allen Bradley Remote I/O
- AnyBus-S Reference
- AnyBus-DT Reference

## Interface Board Setup

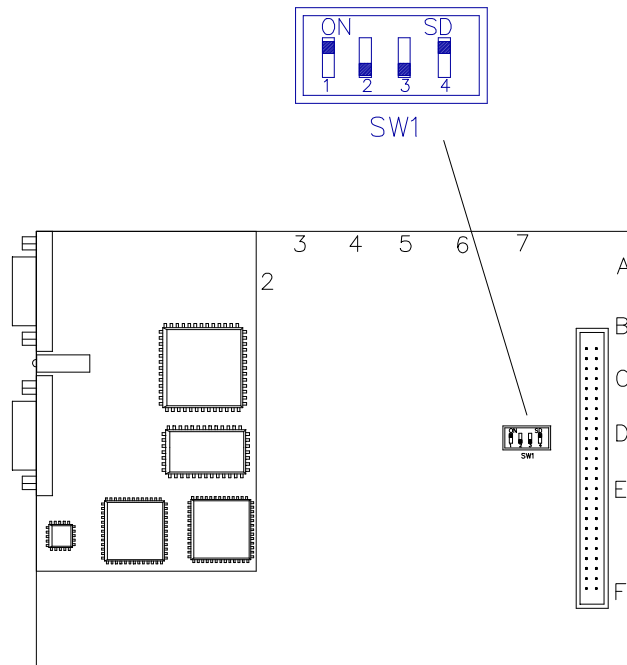
The Multi Unit is able to operate under different Input/Output control structures through use of a modular I/O interface board installed in the unit. With the introduction of “Open” communication networks known as “Fieldbus”, the direct interfacing to these networks became necessary. FEC integrated many of these Fieldbus directly into our system through use of a modular I/O board interfacing these networks directly to our I/O.

The available interfaces are: Discrete I/O control (24VDC Sinking), InterBus S, DeviceNet, Profibus, Mitsubishi CCLink & Allen Bradley Remote I/O. The fieldbus interface boards are integrated directly to internal I/O signals which eliminate associated I/O wiring thus reducing overall assembly labor. In fieldbus systems, the communication is typically of the Master/Slave format in which the FEC unit is a slave to the master CPU.

All I/O Motherboards have a DIP Switch SW1 (located at position 7D) which has to be configured so the Multi Unit can identify the type of interface installed.

### To install an interface board:

- 1 Set the DIP Switch SW1 according to the table shown below.
- 2 Open the Multi Unit and mount the interface board.
- 3 Connect the ribbon cable from the Multi board CN2 to the interface board CN1.
- 4 Assemble the Multi Unit.



SW1 DIP Switch setting for I/O board selection					
Part # Suffix	SW1 1	SW1 2	SW1 3	SW1 4	INTERFACE TYPE
-1	ON	OFF	OFF	OFF	24VDC Sink Discrete I/O
-2	OFF	ON	OFF	OFF	24VDC Source Discrete I/O
-3	ON	ON	OFF	OFF	DeviceNet - DT
-4	OFF	OFF	ON	OFF	DeviceNet(Estop) - DT
-5	ON	OFF	ON	OFF	Interbus S - DT
-6	OFF	ON	ON	OFF	Allen Bradley Remote I/O
-7	ON	ON	ON	OFF	Profibus - DT
-8	OFF	OFF	OFF	ON	Reserved
-9	ON	OFF	OFF	ON	Devicenet - S
-10	OFF	ON	OFF	ON	Reserved
-11	ON	ON	OFF	ON	Interbus S - S
-12	OFF	OFF	ON	ON	Reserved
-13	ON	OFF	ON	ON	Profibus - S
-14	OFF	ON	ON	ON	CCLink* (Switches 5-8 NOT USED)
-15	ON	ON	ON	ON	M-Net

Part # suffix refers to number added to Multi Unit Part number

(example: 1500Multi - 13 is a Multi unit with a Profibus -S interface board installed)

-DT & -S boards refer to type of interface adapter installed.

-DT = Data transfer model(old model)

-S = Serial model (current model)

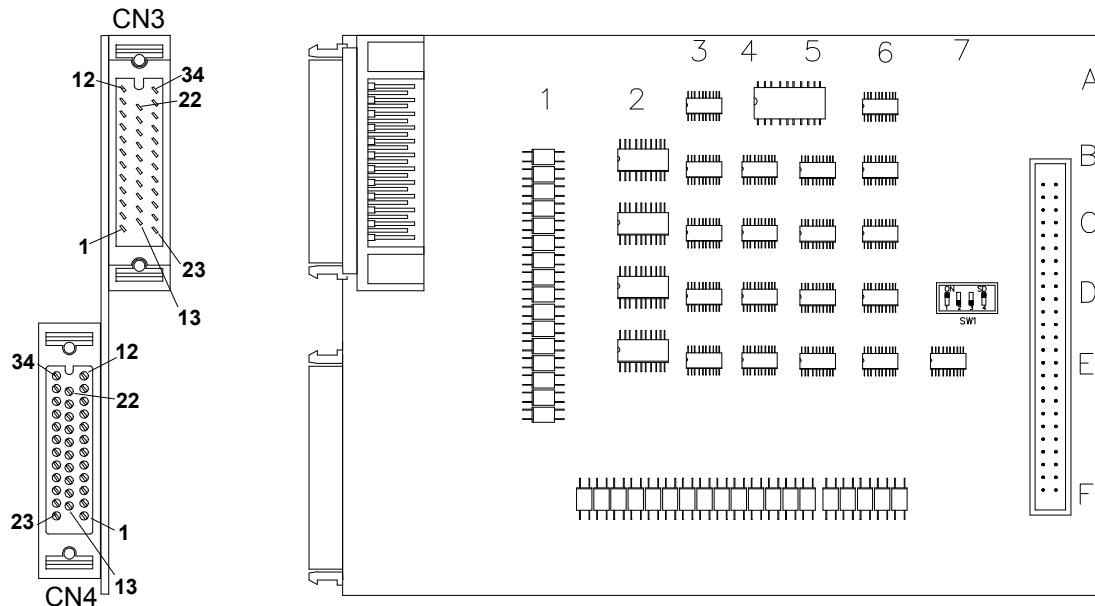
Devicenet (Estop) version is without Estop signal control

## Discrete I/O Interface

The Discrete I/O Interface is commonly used for direct connect PLC applications. Although each individual AFC1500 Servo Controller can be wired directly to a PLC through its own PLC I/O port (for individual control), by using the Multi Unit , only the Multi Unit needs to be connected to the PLC, eliminating the individual spindle I/O connection, thus reducing PLC I/O quantities.

CN3 : PLC1 Connector (Inputs)

CN4 : PLC2 Connector (Outputs)



Connector Pin-out (View looking at connector) (Mating Connectors : Honda MR-34M & MR-34F)

## Input/Output Signals

Input (Connector PLC1)	
Pin No.	Signal
1	Stop
2	Reset
3	Reverse
4	Start
5	Sequence Select 0
6	Sequence Select 1
7	Sequence Select 2
8	Sequence Select 3
9	Cycle Count Up
10	Cycle Count Clear
11	Not used
12	Not used
13	In Port 0
14	In Port 1
15	In Port 2
16	In Port 3
17	Bypass Spindle # 1
18	Bypass Spindle # 2
19	Bypass Spindle # 3
20	Bypass Spindle # 4
21	Bypass Spindle # 5
22	Bypass Spindle # 6
23	Bypass Spindle # 7
24	Bypass Spindle # 8
25	Bypass Spindle # 9
26	Bypass Spindle # 10
27	Not Used
28	Not Used
29	Not Used
30	Data Select 0
31	Data Select 1
32	Data Select 2
33	Common (+24 VDC)
34	Common (+24 VDC)

Output (Connector PLC2)	
Pin No.	Signal <sup>2</sup>
1	Reject
2	Accept
3	Abnormal
4	Ready
5	Busy
6	End
7	Sequence 0
8	Sequence 1
9	Sequence 2
10	Sequence 3
11	Out Port 1
12	Out Port 2
13	Out Port 3
14	Out Port 4
15	Out Port 5
16	Out Port 6
17	Out Port 7
18	Out Port 8
19	Spindle in Bypass (Any spindle)
20	Current Limit Warning
21	As configured
22	As configured
23	As configured
24	As configured
25	As configured
26	As configured
27	As configured
28	As configured
29	As configured
30	Always ON / Always OFF
31	Always ON / Always OFF
32	Always ON / Always OFF
33	Common (0 VDC)
34	Common (0 VDC)

### Input Signals (Connector PLC1)

The Input Signals are provided on connector PLC1. Inputs are assigned in the order to the above table. Pins designated as “Not Used” have no input assigned to them.

NOTE: When using Discrete I/O, “Bypass Spindle” input signals assigned to the PLC1 connector only can be used up to 10 individual spindles (From the Multi Unit). When using Discrete I/O and you desire to connect this signal from additional spindles, the signal must be wired from the individual SAN Servo controllers using the SAN PLC connector. An alternative to this is to use a Fieldbus interface which has control of all spindle bypass signals from the interface.

<sup>2</sup> This port is configurable by the User Console and the Data Select Input signals. See Chapter 4 for further reference

## Output Signals (Connector PLC2)

The Multi Unit is capable of providing over 570 Output signals to indicate the status of the Multi Unit and of all the AFC1500 SAN Controllers connected to it (up to 31 controllers). These signals are user configurable using the AFC User Console Software and may be programmed on any designated pin. Up to 8 separate output data “Banks” can be setup, each with 32 different output signals. The Output “Bank” is then selected using the Data Select inputs. (Data Sel 0, Data Sel 1, Data Sel 2) (The output setup listed above is an FEC default setting)

## Bank Select Outputs

When working with the Discrete I/O interface, the output signals are programmed into “Banks” of 32 output signals in up to 8 output “Banks” (Max. 256 outputs). If the required output signals from the Multi Unit exceeds 32 signals, then Bank 2 can be programmed with additional signals. If over 64 signals are required, Bank 3 can be programmed and so on. These Output “Banks” can then be selected by the Data Select input signals. The Data Select input signals 0, 1 & 2 together form a binary code to select up to eight (8) different Data Banks. (See Chapter 4 for Bank Select Procedure)

**Note:** Bank Select inputs do not function with any interface except the Discrete I/O interface. When using Bank selects, it is recommended that the bank number be monitored to confirm actual output status of shared discrete output points. This can be performed by using the “Always On/Off” bits set-up in specific discrete output points when programming the output points with the AFC User Console Software. For this function, program the “Always On/Off” bits to mimic the Data Select input bits. “Always On” bits will turn on the output in that particular Bank as soon as the bank is selected. “Always Off” bits will turn off the output in the particular Bank which is selected. Using different combinations of these bits programmed in a output in each Bank will allow monitoring of which Bank is selected.

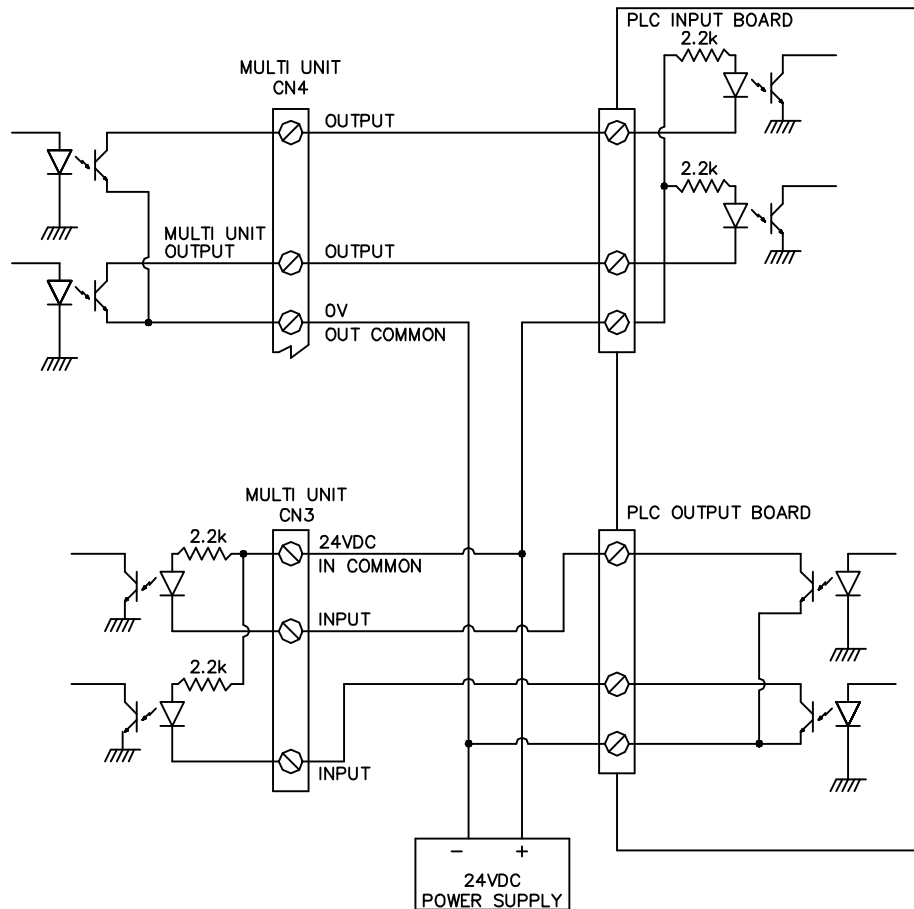
The number of discrete outputs used for this function depends on how many Banks are required as shown below;

Number of Banks Required	Number of Discrete Outputs Required
1	0 or 1
2-4	2
5-8	3

Typically these “Always On / Off” bits are programmed in the last output points (Pins 30 -32 as shown on previous page).

## Discrete Signal Connection

The Discrete I/O Interface operates with 24VDC Sink type (True Low) connections as a default. (Contact FEC if 24VDC Source type (True High) connections are desired) Typical configuration connection is shown in the figure below;



### Discrete I/O Port Specifications

Operating Voltage	24 VDC
Maximum current (outputs)	200 ma
Logic	True Low (Sinking)
Connector	CN3: Input
	CN4: Output

### Standard I/O Cable - Wire Color Code

The table below shows the color code of the standard FEC Discrete I/O cable used for I/O connectors CN3 and CN4.

(FEC Cable Drawing FEB -1206)

Pin No.	Wire Color
1	Black
2	Brown
3	Red
4	Orange
5	Yellow
6	Green
7	Blue
8	Violet
9	Gray
10	White
11	White/Black
12	White/Brown
13	White/Red
14	White/Orange
15	White/Yellow
16	White/Green
17	White/Blue
18	White/Violet
19	White/Gray
20	White/Black/Brown
21	White/Black/Red
22	White/Black/Orange
23	White/Black/Yellow
24	White/Black/Green
25	White/Black/Blue
26	White/Black/Violet
27	White/Black/Gray
28	White/Brown/Red
29	White/Brown/Orange
30	White/Brown/Yellow
31	White/Brown/Green
32	White/Brown/Blue
33	White/Brown/Violet
34	White/Brown/Gray

## InterBus S Interface Board

InterBus S from Phoenix Contact is a open ring-based, distributed device I/O network. I/O data is transmitted in frames that provide simultaneous and predictable updates to all devices in the network. This interface board (S - version) has up to 512 bytes of assigned input data and 512 bytes of assigned output data\* (64bytes default), two DB9 connectors and status LEDs. The 64 bytes of assigned I/O data allows a maximum of 512 inputs and 512 outputs per node. FEC I/O is assigned to the I/O points in these data areas (some I/O will be designated spare). FEC Inputs match the Discrete input layout. FEC Output location is programmed using the AFC User Console Software.

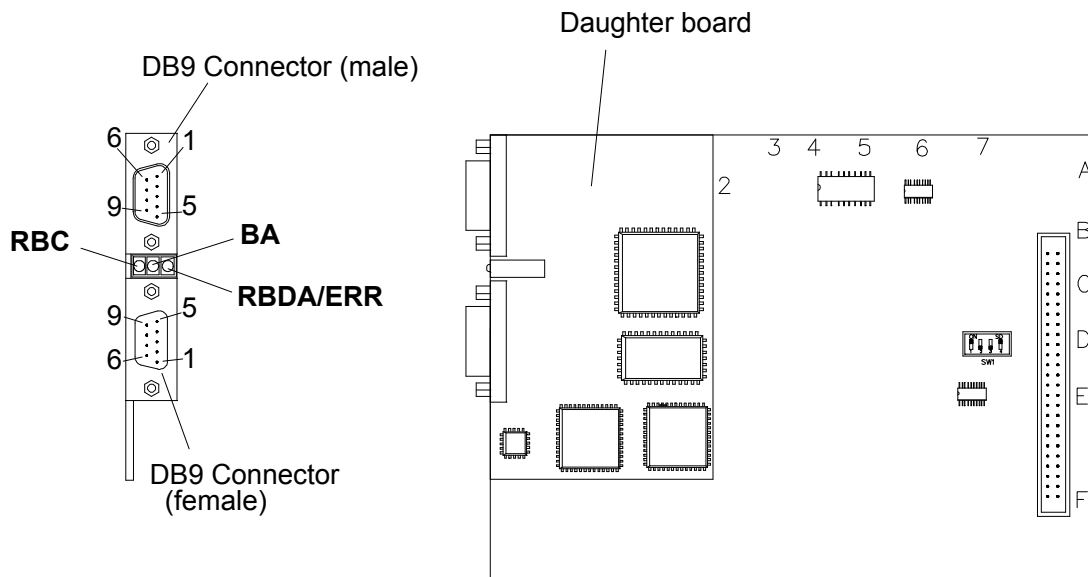
\* When using Master boards where the PCP channel is NOT supported, the maximum number of I/O will be 20 input bytes/ 20 output bytes.

FEC integrates the Interbus-S board manufactured by HMS Fieldbus Systems AB into the Multi-Unit modular I/O board. For further technical information on the Interbus-S interface go to the HMS website. ([www.hms.se](http://www.hms.se))

InterBus Specifications	
Speed	500K baud
Nodes	256
Distance	400 m
Cable	Point to point twisted pair
Packet Size	1-256 words
Communication Type	Master/Slave

Interface Specifications	
Input data bytes (including free data)	512 (Default: 64 input data*)
Output data bytes (including free data)	512 (Default: 64 output data*)
Inters Interface type	Remote bus interface
Operating Voltage	+5VDC / 200 ma
Data Width	4 words (1 word PCP, 3 word data)
ID Code	F3 Hex
Status Indicator	3 LED's
Output objects	6000H, 6001H
Input objects	6002H, 6003H

\* Actual Input/Output data length is configurable using the AFC Software package. (See AnyBus-S Reference at the end of this chapter for I/O Setting example.)



## Indication LED

### Status LEDs

1	RBDA - Remote Bus Disable	Red when outgoing bus is disabled
2	TR - Transmit/Receive	Green if PCP channel is carried on Interbus
3	CC - Cable Check	Green if cable connection good & master not in reset
4	BA - Bus Active	Green when monitoring layer 2
5	UL - Voltage OK at bus	Green if voltage is OK

**Watchdog LED-** There is one additional bicolor Watchdog LED on the interface board (inside unit). After the module is initialized by the application, the LED will flash in a 1 sec. interval if running properly. Prior to initialization by the application then the LED will flash with a 2 second interval.

### InterBus connectors- BUS IN

Pin 1	TXD+	DO1
Pin 2	RXD+	DI1
Pin 3	Isolated Ground	ISOGND
Pin 4		
Pin 5		
Pin 6	TXD-	/DO1
Pin 7	RXD-	/DI1
Shield	PE Earth Ground	PE

InterBus connectors- BUS OUT		
Pin 1	TXD+	DO2
Pin 2	RXD+	DI2
Pin 3,5	Isolated Ground	ISOGND
Pin 4		
Pin 6	TXD-	/DO2
Pin 7	RXD-	/DI2
Pin 9		RBST
Shield	PE Earth Ground	PE

### Termination

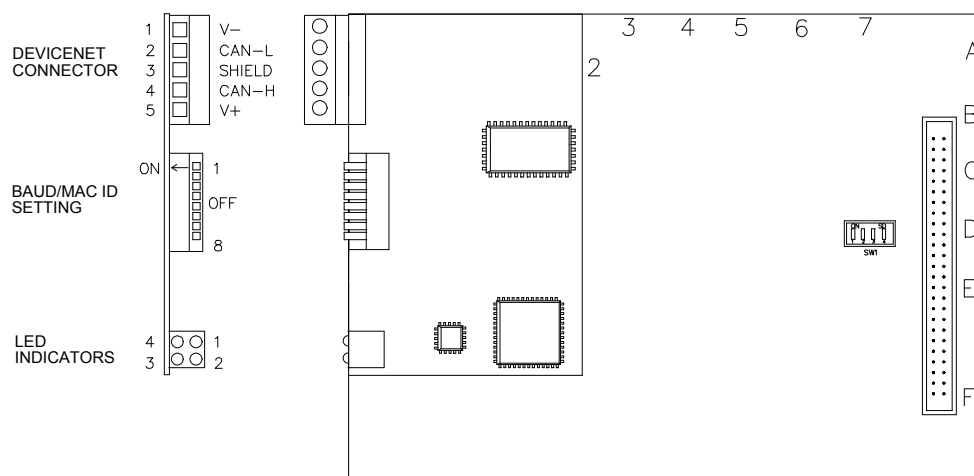
Always terminate RBST to ground if it is not the last module on the bus. If the RBST is not connected to ground, the interface will automatically terminate the bus.

## DeviceNet Interface board

The DeviceNet communication interface allows slave connection to an industrial DeviceNet network. DeviceNet allows industrial devices to be controlled over an open network architecture enabling device connection at various locations in the field. This “Fieldbus” technology reduces hardwiring/cabling & provides ease of installation. It uses a broadcast-oriented protocol -the CAN (Controller Area Network)- that can interface to many devices such as limit switches, sensors, directional valves, motor starters, bar code readers, process sensors, frequency drives, etc. The network can have up to 64 nodes. Its maximum communication baud rate is 500K baud with a maximum cable distance of 100 m., 250 K baud at a 250m max. cable length or 125K baud with a maximum cable distance of 500m. Node addressing (MAC ID) & baud rate is selectable using the baud/address selection DIP switch. Module & Network status LED's provide network diagnostics. Maximum I/O data is 512 input bytes & 512 output bytes. FEC Inputs match the Discrete input layout. FEC Output location is programmed using the AFC User Console Software.

Note: The DeviceNet interface is implemented according to the ODVA specification for a communications adapter (profile no.12). It is acting as a “group two only server” on the DeviceNet network.

FEC integrates the DeviceNet board manufactured by HMS Fieldbus Systems AB into the Multi-Unit modular I/O board. For further technical information on the DeviceNet interface go to the HMS website. ([www.hms.se](http://www.hms.se)) Further DeviceNet information can be found through the Open DeviceNet Vendors Association (ODVA). ([www.ODVA.org](http://www.ODVA.org))



## Termination

Termination of the fieldbus requires a terminating resistor at each end of the fieldbus. These resistors should have a value of 121 ohms.

## EDS File

Each device on a DeviceNet network is associated with an EDS file containing all necessary information about the device to be connected. The network configuration program uses this file during configuration of the network.

The EDS file associated with the FEC device can be downloaded from the FEC website. [www.fec-usa.com](http://www.fec-usa.com) (file: abs.eds)

Direct link: [www.fec-usa.com/fecusacomnew/support/index.htm](http://www.fec-usa.com/fecusacomnew/support/index.htm)

(the file can also be downloaded directly from HMS - [www.hms.se](http://www.hms.se))

Note: The FEC system will appear in the network Vendor list as “HMS Fieldbus Systems” and in the network as “Anybus-S Devicenet” adapter. This is the manufacturer of the interface board which is integrated into the Multi Unit.

DeviceNet Specifications	
Speed	500K baud max.
Nodes	64
Distance	500m max.
Cable	Twisted pair for signal and power Allen Bradley or equivalent ; Thin Cable #1485C-P1-C Thick Cable # 1485C-P1-A
Communications Type	Master/Slave

DeviceNet connector		
Pin 1	V-	Black
Pin 2	CAN_L	Blue
Pin 3	Drain/Shield	
Pin 4	CAN_H	White
Pin 5	V+	Red

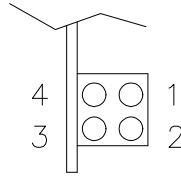
Interface Board Specifications	
Operating Voltage	+5V, 200 ma
Baud rate configuration	Board switches 1 & 2
MAC ID setting	Board switches 3 to 8
Output data bytes	512 max.*
Input data bytes	512 max.*
Status indicator	4 LEDs for module and network status
Servers per group	2 Maximum
Interface type	Dual Port RAM or Serial Interface

\* Typical configuration is 32 Bytes (256 I/O points) but can be altered using the AFC Software package. (See AnyBus-S Reference at the end of this chapter for I/O Setting example.)

See section 4 (I/O signals) for reference of typical fieldbus I/O layout.

**Operation Note:** The first 16 bits of I/O are used by Devicenet communication. The first input must be set “ON” to enable communication.

## Indication LED



Status LEDs (#1 & 4 not used)		
Module Status LED (#2)	Off	No Power
	Green solid	Device Operational - no errors
	Red flashing	Minor Recoverable fault
	Red solid	Unrecoverable module fault
Network Status LED (#3)	Off	Not Powered / Not Online
	Green flashing	On-line but not connected.
	Green solid	On-line, link OK, connected.
	Red flashing	Connection Time Out
	Red solid	Critical Link Failure

MAC ID setting (Board switch)						
SW-3	SW-4	SW-5	SW-6	SW-7	SW-8 (LSB)	MAC ID
OFF	OFF	OFF	OFF	OFF	OFF	Address 0
OFF	OFF	OFF	OFF	OFF	ON	Address 1
OFF	OFF	OFF	OFF	ON	OFF	Address 2
OFF	OFF	OFF	OFF	ON	ON	Address 3
.	.	.	.	.	.	.
ON	ON	ON	ON	OFF	ON	Address 61
ON	ON	ON	ON	ON	OFF	Address 62
ON	ON	ON	ON	ON	ON	Address 63

This switch must be set before power is on, and cannot be changed during operation.

Baud rate setting (Board switch)		
SW-1	SW-2	Baud rate
OFF	OFF	125K
OFF	ON	250K
ON	OFF	500K
ON	ON	Reserved

This switch must be set before power is on, and cannot be changed during operation.

## Profibus Interface Board

The Profibus-DP communication interface allows slave connection to an industrial Profibus-DP network. Profibus-DP allows industrial devices to be controlled over an open network architecture enabling device connection at various locations in the field. This “Fieldbus” technology reduces hardwiring/cabling & provides ease of installation. It can interface to many devices such as limit switches, sensors, directional valves, motor starters, bar code readers, process sensors, frequency drives, etc. The network can have up to 126 nodes. Its maximum communication baud rate is 12M baud and its minimum baud rate is 9.6K baud.

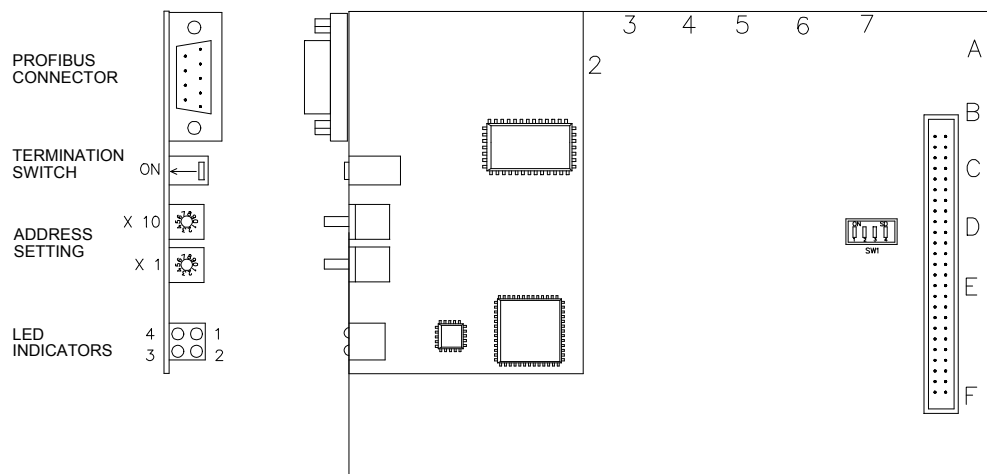
Node addressing is selectable using the address selection switch. Baud rate is auto detected from the master and no user setup is required. Module & Network status LED's provide network diagnostics. Maximum I/O data is 244 input bytes & 244 output bytes. FEC Inputs match the Discrete input layout. FEC Output location is programmed using the AFC User Console Software.

Note: The Profibus-DP interface is implemented according to the Profibus-DP EN 50 170 (DIN 19245 Part 1) specification.

FEC integrates the Profibus-DP board manufactured by HMS Fieldbus Systems AB into the Multi-Unit modular I/O board. For further technical information on the Profibus-DP interface go to the HMS website.

([www.hms.se](http://www.hms.se))

Further Profibus information can be found on the Profibus website at [www.profibus.com](http://www.profibus.com).



## Termination

Termination of the fieldbus requires a terminating resistor at each end of the fieldbus. A termination switch is provided on the Profibus-DP interface board. Set the switch to “ON”, if termination is required. If external terminators are used, the switch must be in the off position.

## GSD File

Each device on a Profibus network is associated with an GSD file containing all necessary information about the device to be connected. The network configuration program uses this file during configuration of the network.

The GSD file associated with the FEC device can be downloaded from the FEC website. [www.fec-usa.com](http://www.fec-usa.com) (File : hms\_1003.gsd)

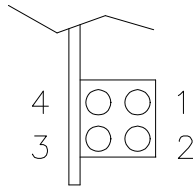
Direct link:[www.fec-usa.com/fecusacomnew/support/index.htm](http://www.fec-usa.com/fecusacomnew/support/index.htm)

(the file can also be downloaded directly from HMS - [www.hms.se](http://www.hms.se))

Profibus Specifications	
Speed	9.6K - 12M baud - autoselected
Nodes	126 Note:Node 126 is reserved for commisioning purposes only
Distance	200m max. at 1.5Mbit/s extendable with repeaters.
Cable	Shielded Copper Twisted Pair or fiber optic
Communications Type	Master/Slave - EIA RS485
Protocol Version	Ver. 1.10
Maximum Cyclic I/O Size	244bytes In, 244 bytes out max. 416 total bytes max.
Data transmission	The module only supports cyclic I/O data transmission.

Profibus connector - D-Sub		
Pin 1	Not Connected	
Pin 2	Not Connected	
Pin 3	B- Line	Positive RxD/TxD according to RS485 Spec.
Pin 4	RTS	Request to send
Pin 5	GND Bus	Isolated GND from RS 485 side
Pin 6	+5V Bus	Isolated +5V from RS 485 side
Pin 7	Not connected	
Pin 8	A- Line	Negative RxD/TxD according to RS485 Spec.
Pin 9	Not Connected	
Housing	Shield	Connected to PE

## Indication LED



Status LEDs		
Fieldbus Diagnostics	Red	Indicates faults on fieldbus side
LED #4	Flashing Red - 1sec	Config. Error - in/out length set at module initialize does not match length in network config.
	Flashing Red - 2sec	Error in user parameter data - parameter length/content does not match network length/content
	Flashing Red - 4sec	Error in initialization of Profibus communication ASIC
On-Line LED #2	Off	Module not online
	Green	Module online and communication OK
Off-Line LED #3	Off	Module is not offline
	Red	Module is offline on the fieldbus

LED #1- Not Used

## Node Address

Before configuring the Profibus-DP module the node address has to be set. This is done with two rotary switches on the module which can set the node address 1-99 in decimal format. The Upper rotary switch (closest to the D-sub) sets the “ten” digit (X 10), and the bottom rotary switch sets the single digit. Example: To set node 37, place the “ten” switch on 3, and the single digit switch on 7.

This switch must be set before power is on, and cannot be changed during operation.

## Configuration

FEC Profibus I/O configuration is programmable using the AFC User Console software. I/O can be set as required by the application according to parameter limits set forth by the GSD (Profibus) configuration file. The AFC Software allows configuration of the number of I/O in the Multi Unit. Configuration of the Profibus Master MUST match the configuration of the FEC Profibus slave. In the Profibus Master set-up, input size and output size is set as “byte”

ordering. (Do not use “word” ordering. This will inverse the I/O location)  
When setting the Profibus Master configuration, PLC input size refers to FEC output size (ie. Accept, Reject, Busy, etc.) and PLC output size refers to FEC inputs (ie. Start, Stop, Reset, etc.). FEC will show up as 2 modules. Module 1 is inputs, module 2 is outputs. (See AnyBus-S Reference at the end of this chapter for I/O Setting example.)

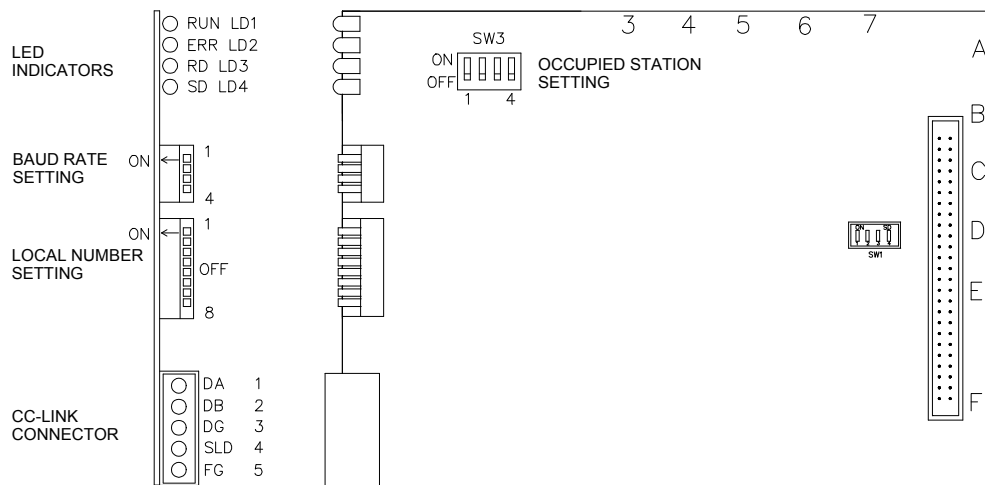
## Mitsubishi CC-Link

The Mitsubishi CC-Link communication interface allows slave connection to an industrial Mitsubishi CC-Link network. FEC has a partner license with Mitsubishi for the AFC1500 system for connection on the CC-Link network. Mitsubishi CC-Link allows industrial devices to be controlled over an open network architecture enabling device connection at various locations in the field. This “Fieldbus” technology reduces hardwiring/cabling & provides ease of installation. It can interface to many devices such as limit switches, sensors, directional valves, motor starters, bar code readers, process sensors, frequency drives, etc. The network can have up to 64 stations. Its maximum communication baud rate is 10M baud and it’s minimum baud rate is 156K baud.

Station addressing is selectable using the Station selection switch as well as the number of occupied (32bit) stations using another selection DIP switch. Baud rate is DIP switch selectable. Module & Network status LED’s provide diagnostics. Maximum I/O data is 128 inputs & 128 outputs.

**NOTE:** The FEC CC-Link module is configured as a “**Remote Device Station**” when setting up the parameters in the PLC program.

For detailed information on the Mitsubishi CC-Link Network, see the Mitsubishi User Manual # 13J872 Control & Communication - Link System Master / Local Module.



## Termination

Termination of the CCLink requires a terminating resistor at each end of the fieldbus. Connect 120 ohm resistor between the DA & DB terminals if this is the last connection. (Remember that the CCLink master also needs to be terminated)

CC Link Specifications	
Speed	156K - 10M baud - selectable
Stations	64 Max.
Distance	1200m max. at 156K baud / 50m max. at 10Mbit/s
Cable	Shielded Copper Twisted Pair Mitsubishi BA1SJ61-(m) m=Meters Belden 8102 or equivalent
Communications Type	Master/Slave - EIA RS485
Transmission Format	HDLC Standard
Maximum Cyclic I/O Size	128 inputs, 128 outputs max. Size set in groups of 32 I/O (Occupied Stations)
I/O Configuration*	I/O addressing set by PLC TO / FROM commands in Logic

\* Actual I/O addressing must be assigned in the PLC logic. See the Mitsubishi User Manual # 13J872 Control & Communication - Link System Master / Local Module for logic reference. (Ref. Section 10)

CC-Link connector		
Pin 1	DA	Communication Line
Pin 2	DB	Communication Line
Pin 3	DG	Digital Ground
Pin 4	SHIELD	Connect cable shield
Pin 5	FG	Field Ground

Connector: 5.08mm BU04/5 Hartmann or Equivalent

Wiring of the CC-Link network should be performed by using the cable listed above in the CC-Link Specifications. The three twisted conductors should be wired in series to each CC-Link device, using a terminating resistor at the Master end and on the last Remote/Local device between the DA & DB terminals. Connection should be DA to DA, DB to DB, DG to DG with the cable shield connected to the SHIELD terminal. The field ground (FG) should be connected to earth ground.

Station Number Setting (SW1)								
SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	Station #
ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	1
OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	2
.	.	.	.	.	.	.	.	.
OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	10
.	.	.	.	.	.	.	.	.
ON	ON	ON	OFF	OFF	OFF	ON	OFF	47
.	.	.	.	.	.	.	.	.
OFF	OFF	ON	OFF	OFF	ON	ON	OFF	64

Station Number sets the address in the CC-Link network. Max. number of stations is 64. No two devices may share the same address. Switch setting format is Binary Coded Decimal (BCD) Switch 1-4 is Least Significant Byte (LSB). Switch 5-8 is Most Significant Byte (MSB). This switch must be set before power is on, and cannot be changed during operation.

Baud rate setting (SW2)				
SW-1	SW-2	SW-3	SW-4	Baud rate
OFF	OFF	OFF	OFF	156K
ON	OFF	OFF	OFF	625K
OFF	ON	OFF	OFF	2.5M
ON	ON	OFF	OFF	5M
OFF	OFF	ON	OFF	10M

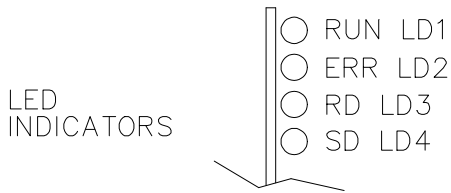
This setting **MUST** match the setting of the Master module. This switch must be set before power is on, and cannot be changed during operation.

Number of Occupied Stations (SW3)					
Number of Stations	SW-1	SW-2	SW-3	SW-4	
1 (32 In/32 Out)	ON	ON	ON	OFF	
2 (64 In/64 Out)	ON	OFF	ON	OFF	
3 (96 In/96 Out)	OFF	ON	ON	OFF	
4 (128 In/128 Out)	OFF	OFF	ON	OFF	

Occupied Stations setting determines the number of 32 bit station buffer memory locations that will be allocated for this station in the Master buffer memory. This sets the number of total I/O available for the station. Each memory bit has a designated input AND output buffer. So a setting of (1) 32 station actually allocates 32 input & 32 output locations for a total of 64 total points. This switch must be set before power is on, and cannot be changed during operation.

**NOTE:** See FEC Electrical Controls drawings for actual setting required as this may vary per application.

## Indication LED



Status LEDs		
RUN	OFF	Watchdog Timer error
	ON	Module is Normal - Running
ERR	OFF	Normal
	ON - Steady	Communication error at all Stations
	ON - Flashing	Communication error at Station
SD	Send Data	Module Sending Data
RD	Read Data	Module Reading Data

## Configuration

Configuration of the CCLink system is done in the PLC Logic. It is essential that this configuration matches the Dip Switch settings of the FEC CCLink slave. FEC is considered a “**Remote Device**” in the PLC configuration. The number of “Occupied Stations” set in the PLC must also match the Dip Switch set-up. (Note: The last 16 output addresses are used by the CCLink communication & cannot be used by the user) Below is an example of the PLC configuration setting for the FEC Node in the CCLink network;

### Command

[**MOV H1306 D19**]

### Description

**MOV** = Move command

**H** = Hex number being used

**1** = Remote Device (0= Remote I/O Station, 2= Intelligent Device)

**3** = 3 Occupied Stations (3 x 32I/O = 96 Inputs & Outputs, (4 is max.))

**06** = Station #6 (CCLink address, 64 max.)

**D19** = PLC register which stores the configuration (could be any register #)

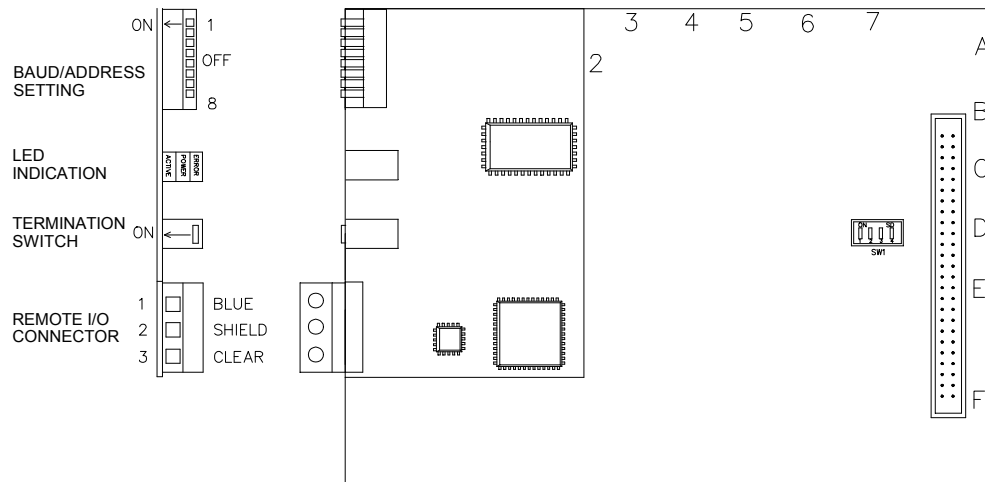
Note: This is only an example of the station setting configuration. Other configuration must be completed in the PLC logic for proper operation. The PLC configuration **MUST** match the settings of the FEC Dip Switches. The communication link will not be established and the red “ERR” LED will be lit if these settings do not match. Please review the Mitsubishi CCLink manual #13J872 for further information.

## Allen Bradley Remote I/O Interface board

The Allen Bradley (AB) Remote I/O communication interface allows slave connection to an AB Remote I/O network. FEC has licensed (Lic. #199906006) the use of the AB Remote I/O interface board (through HMS Fieldbus Systems). AB Remote I/O is a proprietary Fieldbus of Allen Bradley. AB - RIO allows industrial devices to be controlled over a network architecture enabling device connection at various locations in the field. This “Fieldbus” technology reduces hardwiring/cabling & provides ease of installation. The network can have up to 240 nodes with valid rack addresses of 0-59. Its maximum communication baud rate is 230K baud with two other settings of 115K & 57.6K baud.

Rack addressing & baud rate is selectable using the baud/address selection DIP switch. Module status LED's provide network diagnostics. Maximum I/O data is 128 inputs & 128 outputs (Full Rack). 1/4, 1/2, 3/4 & Full rack configuration is supported. (Default config. is 1/2 Rack 64In/64Out)

FEC integrates the AB Remote I/O board manufactured by HMS Fieldbus Systems into the Multi-Unit modular I/O board. For further technical information on the AB Remote I/O interface see the AnyBus -DT reference found at the end of this chapter or go to the HMS website. ([www.hms.se](http://www.hms.se)) Further AB Remote I/O information can be found through Allen Bradley's website. ([www.ab.com](http://www.ab.com))



## Termination

Termination of the RIO network requires a terminating resistor at each end of the network. If this is the last module on the network, turn “ON” the terminating switch located on the interface board.

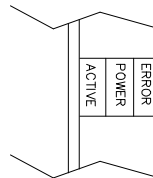
AB Remote I/O Specifications	
Speed	57.6, 115, 230K baud - Selectable
Rack Addresses	0-59
Nodes	up to 240 1/4 racks
Rack Configuration supported*	1/4, 1/2 (Default), 3/4, Full
Distance	57.6k - 3048 meter 115K - 1524 meter 230K - 762 meter
Cable	78 ohm Twinax Belden #9463 or equivalent
Communications Type	Master/Slave

\*Rack Config. set by AFC User Console software. Contact FEC for other setting.

AB Remote I/O connector		
Pin 1	COM line	Blue
Pin 2	GND	Shield
Pin 3	COM line	Clear

## Indication LED

LED  
INDICATOR



Status LEDs		
Error	OFF	Normal Operation
	ON - Red	Bus off / Error
Active	OFF	No Communication
	ON - Green	Communication Active
Power	OFF	Power Off
	ON - Green	Power On

Address setting (DIP switch)						
SW-3 (LSB)	SW-4	SW-5	SW-6	SW-7	SW-8	MAC ID
OFF	OFF	OFF	OFF	OFF	OFF	Address 0*
ON	OFF	OFF	OFF	OFF	OFF	Address 1
OFF	ON	OFF	OFF	OFF	OFF	Address 2
ON	ON	OFF	OFF	OFF	OFF	Address 3
.	.	.	.	.	.	.
ON	OFF	OFF	ON	ON	ON	Address 57
OFF	ON	OFF	ON	ON	ON	Address 58
ON	ON	OFF	ON	ON	ON	Address 59

This switch must be set before power is on, and cannot be changed during operation.

\*Address should be set to “0” if this is the only device on the network.

Baud rate setting (Board switch)		
SW-1	SW-2	Baud rate
OFF	OFF	57.6K
ON	OFF	115K
OFF	ON	230K
ON	ON	Reserved

Baud rate must match the settings of the Remote I/O scanner.

This switch must be set before power is on, and cannot be changed during operation.

## Fieldbus I/O Assignment

See Input/Output Signal & Fastening Data Outline Section (4) for a description of the I/O and it's assignment location.

## ANYBUS-S Reference

### AnyBus S Initialization

FEC incorporates the ANYBUS module as the interface to various fieldbus communication devices. (manufactured by HMS, [www.hms.se](http://www.hms.se)) It is initialized by the AFC 1500 Multi Unit which sets certain parameters including the size of the Input / Output tables to be used for the particular fieldbus. All fieldbus's except for the Allen Bradley Remote I/O use the "-S" type of AnyBus Card. This provides interchangeability between the cards while minimizing software changes. This also allows FEC to set parameters to all the different types of fieldbus cards with the same parameter set-up software. The AFC User Console has the function included to set the parameters, mainly Input / Output size, to the Anybus card. Below is an example of the command structure. The "Message Data" area near the bottom is where the I/O size is set.

**NOTE: FEC sets this at the Factory, and does not recommend setting this by the end user. This information is provided for reference only.**

#### Command Layout

<u>Register Name</u>	<u>Command</u>	
Message ID	000A	
Message Info	4001	
Command	0002	
Data size	0012	
Frame Count	0001	
Frame Number	0001	
Offset High	0000	
Offset Low	0000	
Extended word 1	-	
Extended word 2	-	
Extended word 3	-	
Extended word 4	-	
Extended word 5	-	
Extended word 6	-	
Extended word 7	-	
Extended word 8	-	
Message Data word 1	IN I/O Length	0010 (16 bytes 128 inputs)
Message Data word 2	IN DRAM Length	0010 (FEC outputs)
Message Data word 3	IN Total Length	0010
Message Data word 4	OUT I/O Length	0008 (8 bytes 64 outputs)
Message Data word 5	OUT DRAM Length	0008 (FEC Inputs)
Message Data word 6	OUT Total Length	0008
Message Data word 7	Module Status	0002
Message Data word 8	Interrupt Notification	0003
Message Data word 9	Watchdog Counter	0000

In the AFC User console Multi-fieldbus setup, the (S Type) setup menu is used to input/download this data. Other commands are required to transfer this data, but the command "000A" is the command which sets the I/O size.

## AnyBus - DT Reference (Allen Bradley Remote I/O)

### AnyBus DT Initialization

FEC incorporates the ANYBUS module as the interface to various fieldbus communication devices. (manufactured by HMS, [www.hms.se](http://www.hms.se)) It is initialized by the AFC 1500 Multi Unit which sets certain parameters including the size of the Input / Output tables to be used for the particular fieldbus. The DT model is only used for the FEC Allen Bradley Remote I/O interface. The AFC User Console software package is able to configure setup parameters for Allen Bradley Remote I/O as shown below. (The (DT Type) setup menu is used to input/download this data.)

**NOTE: FEC sets this at the Factory, and does not recommend setting this by the end user. This information is provided for reference only.**

DT Address	Name	Description
3D0h	RIO Data Rate	0: 57.6 kbits/sec 1: 115.2 kbits/sec 2: 230.4 kbits/sec 3-255 Not valid (set at 2) Default value read from Dip Switch
3D1h	RIO Rack Address	0x00 - 0x3b valid rack address 0x3c - 0xff invalid setting, set at 0x3b Default value read from Dip Switch
3D2h	RIO Rack Size	0: 1/4 rack 1: 1/2 rack (default) 2: 3/4 rack 3: Full rack 4-255: Not Valid, (set to 3)
3D3h	RIO Start Quarter	0: 1st (default) 1: 2nd 2: 3rd 3: 4th 4-255: not valid (set to 3) Only 0 is valid in block transfer mode
3D4h	RIO Last Rack	0: Not last rack (default) 1: Last Rack 2-255: Not valid (set to 1)
3D5h	RIO Restart Lockout	0: module reinitializes on communication fault (default) 1: Module locks out, restart with power down 2-255: Not valid (Set at 1)
3D6h	Not used	
3D7h	RIO IO Mode	0: Mixed mode 1: Mixed mode- IO start at byte 2 2: Only Block transfer 3: Only discrete data (default) 4-255: not valid (set at 3)

(This page left intentionally blank)

# Input / Output Signals and Fastening Data Outline

**This chapter provides a description of all input and output control signals, typical I/O layout (for fieldbus) and Fastening output data available in the Multi Unit.**

## **In this chapter**

- **Input Signals**
- **Output Signals**
- **Signal Timing**
- **SAN Output Signals**
- **I/O Layout**
- **Abnormal Code**

## Multi Unit Input Signals

Multi Unit Input Signals		
1	<b>Stop</b>	Emergency Stop Input (Normally Closed). Signal MUST be Active to perform fastening. When this signal is inactive (off), all Multi Unit operation ceases, all spindles in motion will stop, and all communication ports & input/outputs will be disabled.
2	<b>Reset</b>	Reset Input (Normally Open). When active (on), this signal will clear all fastening data, and discrete outputs. A Zero Check of all torque transducers will be completed. During the Zero Check, the CHECK lamp will illuminate, the READY signal will turn OFF, and the ACCEPT or REJECT lamp will light to indicate the result of the Zero Check. If the System has been disabled by an Abnormal output, the System will not return to normal operation until the Abnormal condition has been corrected, and this signal has been input for 200~500 ms. Do <u>not</u> input this signal between cycles, as part of an automatic cycle due to the potential for fastening data loss.
3	<b>Reverse</b>	Reverse Spindle Rotation Input (Normally Open). All spindles will rotate in an opposite direction (of fastening) for as long as this signal is activated (on) and maintained. The Reverse input functions the same as the reverse pushbutton on the front of the Multi Unit.
4	<b>Start</b>	Start Cycle Input (Normally Open). The Start input automatically resets the previous cycle, clears all data to zero, and initiates the next fastening cycle. The Start input requires a pulse of 200~500 milliseconds if the Multi Unit is set up for AUTOMATIC Start input. If it is set up for DEADMAN (hand-held operations) input, the Start input must be maintained "on" for the entire cycle. Typically, this signal is held on until confirmation of the "Busy" signal is received.
5	<b>Seq 0</b>	Sequence Select Input (Normally Open). These 4 inputs form a binary code which is capable of selecting up to 16 different operation sequences. Refer to Sequence Select Table.
6	<b>Seq 1</b>	
7	<b>Seq 2</b>	
8	<b>Seq 3</b>	
9	<b>Cycle Count Up</b>	Cycle Count Input (Normally Open). The System cycle counter will increment each time this signal is input if the CYCLE COUNT UP is set to PLC SIGNAL in the Multi Unit. The Cycle Count input requires a pulse of at least 50 ms to increment the counter. If the CYCLE COUNT UP is set to AUTO, the cycle counter increments automatically at the end of every fastening.
10	<b>Cycle Count Clear</b>	Sets the cycle count to Zero.
13	<b>In Port 0</b>	External Sequence Input (Normally Open) These four (4) signals are external inputs to the fastening sequence. When a [PLC INPUT WAIT] instruction is programmed in the fastening sequence, it will stop until the designated external input is active.
14	<b>In Port 1</b>	
15	<b>In Port 2</b>	
16	<b>In Port 3</b>	

Multi Unit Input Signals		
30	<b>Data Select 0</b>	These lines form a binary code to select up to 8 Output Data Banks. Used for Digital I/O interfaces. NOTE: Not Used for Fieldbus interfaces.
31	<b>Data Select 1</b>	
32	<b>Data Select 2</b>	
17*	<b>Bypass Spindle #1</b>	Bypass's spindle #1 - Spindle is ignored as if it does not exist.
.	.	.
26*	<b>Bypass Spindle #10</b>	Bypass's spindle #10 - Spindle is ignored as if it does not exist.
35*	<b>Bypass Spindle #11</b>	Bypass's spindle #11 - Spindle is ignored as if it does not exist.
.	.	.
55*	<b>Bypass Spindle #31</b>	Bypass's spindle #31 - Spindle is ignored as if it does not exist.

\* Spindle Bypass signals can only be used with a Fieldbus interface (except spindle 1-10 is available in discrete I/O) . If using the Discrete I/O interface the spindle bypass signals are wired from the SAN Unit PLC connector (if you have more than 10 spindles) . See I/O layout for input location in fieldbus.

### Sequence Select Table

Sequences are selected using the Sequence Select Bits 0-3. Using these four bits in a binary fashion, 16 sequences can be selected. With all bits “OFF”, sequence #1 is selected and with all bits “ON”, sequence #16 is selected. The Sequence must be set before the start signal is received. It is recommended when using multiple sequences that the Sequence Output signals (SEQ. 0-3) be used to confirm which sequence is selected BEFORE starting the cycle.

Sequence	Seq Select 0	Seq Select 1	Seq Select 2	Seq Select 3
1	off	off	off	off
2	on	off	off	off
3	off	on	off	off
4	on	on	off	off
5	off	off	on	off
6	on	off	on	off
7	off	on	on	off
8	on	on	on	off
9	off	off	off	on
10	on	off	off	on
11	off	on	off	on
12	on	on	off	on
13	off	off	on	on
14	on	off	on	on
15	off	on	on	on
16	on	on	on	on

## Multi Unit Output Signals

The Multi Unit is capable of providing over 570 Output signals to indicate the status of the Multi Unit and all of the AFC1500 SAN Servo Controllers connected to it (up to 31 controllers). By using the AFC User Console Software, it is possible to select the signals to be output and set them in a specific address location. The output layout must be programmed and in effect there is no assigned outputs. However, FEC sets output signals in a typical layout but keep in mind that every application could be different. Refer to the specific applications Electrical Controls drawings for the exact layout.

When working with the Discrete I/O interface, additional output signals required beyond 32 outputs are realized using the “BANK” select function. Up to 8 banks of 32 outputs can be selected, each programmable from the User Console Software. If the Interface is for a Fieldbus application, Bank selecting is not necessary. All outputs required can be programmed to specific fieldbus addresses.

### Bank Select Procedure

When using a discrete I/O interface, the output signals can be arrayed in groups called data “banks” which are selected by the Data Select input signals. The Data Select signals 0, 1 & 2 form together a binary code to select up to eight (8) different Data Banks of 32 outputs as shown below;

Data Select 0	Data Select 1	Data Select 2	Output Data Bank
off	off	off	Bank 1
on	off	off	Bank 2
off	on	off	Bank 3
on	on	off	Bank 4
off	off	on	Bank 5
on	off	on	Bank 6
off	on	on	Bank 7
on	on	on	Bank 8

See Chapter 3 : Bank Select Outputs for more information on Bank Selects.

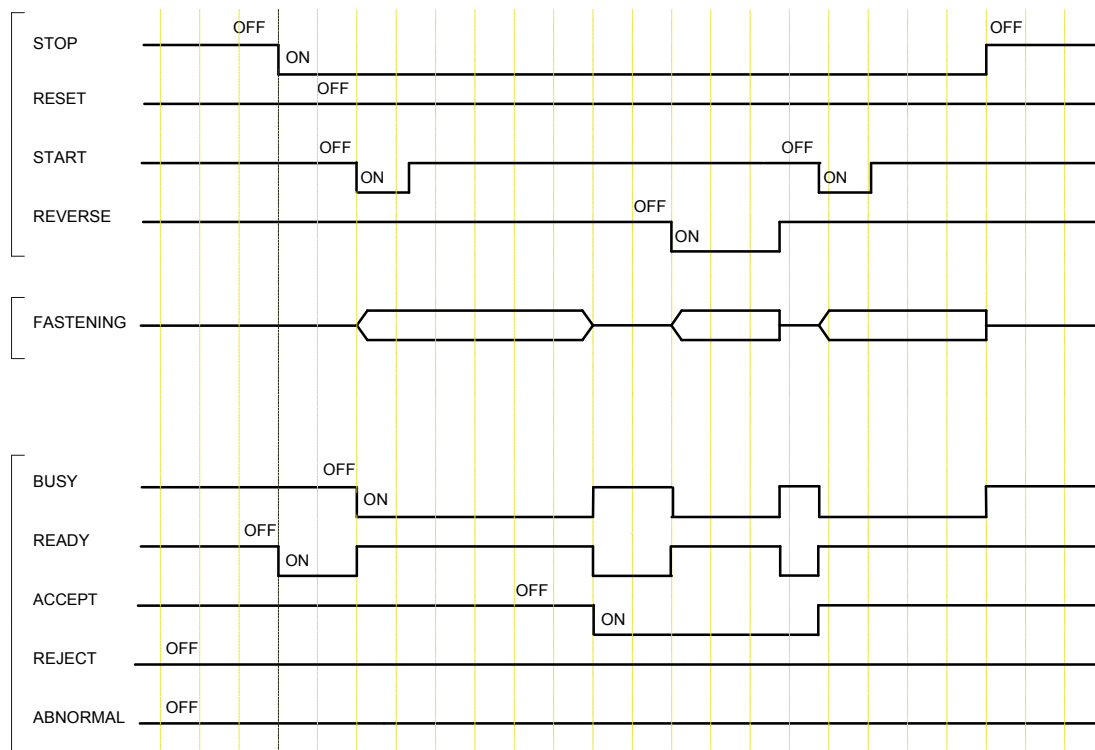
## Multi Unit Output Signals

Each data bank is configurable to contain any of the Multi or AFC1500 SAN Servo Controllers signals listed below

Multi Unit Output Signals		
1	<b>Reject</b>	Output when the fastening result is a REJECT. Indicates that one or more spindles has failed achieving the fastening limits. This output remains active until the START signal or RESET signal is input.
2	<b>Accept</b>	Output when the fastening result is a ACCEPT. Indicates all spindles are within fastening limits. This output remains active until the START signal or RESET signal is input.
3	<b>Abnormal</b>	Output when an Abnormal condition occurs. This signal indicates that the System has detected an internal fault, and can no longer proceed. The fault maybe generated from a connected spindle during a self-check function. Check the individual spindle status to identify which spindle is reporting the abnormal condition. (see AFC1500 Operation Manual for troubleshooting) The spindle reporting an abnormal may be bypassed to resume normal operation, however, the bypassed spindle will be ignored and not run while in bypass. An Abnormal condition must be corrected before the System will resume normal operation. The RESET signal clears the abnormal condition.
4	<b>Ready</b>	Output when the system is in the READY condition. Indicates system is ready to operate, and inputs are enabled. This signal is inactive (off) when the BUSY output is active (on).
5	<b>Busy</b>	Output after a START signal is received, and active until the fastening cycle is complete and the READY signal is output.
6	<b>End</b>	Output when a fastening cycle is complete. Remains active until the START, RESET or REVERSE signal is input.
7	<b>Sequence 0</b>	Output confirmation of SEQUENCE SELECT 0~3 input selections. Sequence bits are active according to what sequence is set from the sequence select inputs. Used to confirm proper sequence <u>before</u> fastening start.
8	<b>Sequence 1</b>	
9	<b>Sequence 2</b>	
10	<b>Sequence 3</b>	
11	<b>Out Port 1</b>	These signals will output, when the fastening sequence reaches a step that has a [PLC OUTPUT] instruction inserted. Used to provide sequence operation status to external PLC's and/or control outputs for slide motion, lights, & buzzers, etc without the use of a PLC. (The AFC User Console Software can set these outputs on and off in the fastening sequence)
12	<b>Out Port 2</b>	
13	<b>Out Port 3</b>	
14	<b>Out Port 4</b>	
15	<b>Out Port 5</b>	
16	<b>Out Port 6</b>	
17	<b>Out Port 7</b>	
18	<b>Out Port 8</b>	
19	<b>Spindle in Bypass</b>	Signal is active when any of the connected spindles are bypassed either from San Unit bypass input signals or from the San Unit bypass switch.
20	<b>Current Limit Warning</b>	Active when high current warning limit has been exceeded. This can be used to identify potential motor failure before total failure occurs by identifying high current draws over what the typical current draw is for the application.
21	<b>Always ON / OFF</b>	Can be used to set outputs ON or OFF . Mainly used in conjunction with Bank Outputs to monitor which Bank is selected
22	<b>Combination Bits 1-8</b>	Used to create "special" outputs formed by using a combination of SAN Unit outputs in "And / Or" logic.

## Signal Timing

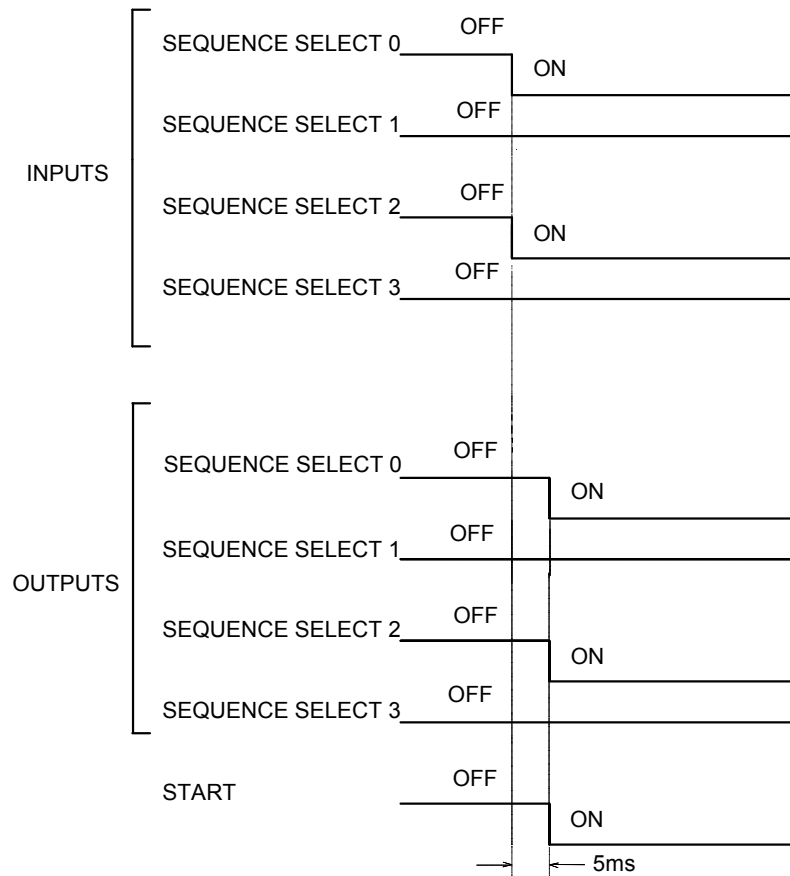
The chart below shows basic Multi Unit signal timing.



- Because the RESET input clears all fastening data, and discrete outputs, it should be activated only to clear a system Abnormal or to perform a Zero Level Check. The System will automatically reset with each fastening, and a Manual RESET activation between cycles could result in data loss. The RESET signal requires a pulse of 200~500 milliseconds.
- The REVERSE signal must be maintained for the duration of the desired REVERSE function.
- The STOP input is Normally Closed, and enables all other functions. When STOP is Open (off), all operations cease and all inputs / outputs become inactive.
- The START signal will not operate during RESET, REVERSE, or ABNORMAL signal activation. The START signal requires a pulse of 200~500 milliseconds for the AUTO START mode. For the DEADMAN mode (Used mainly in handheld applications), the signal must be maintained during the complete fastening cycle.
- When the ABNORMAL signal is active, The system must be RESET before normal operation will resume.
- REJECT / ACCEPT signals are maintained until the start of the next cycle.
- READY will indicate when the system is ready to start.

## Sequence Select Timing

This example shows the sequence select timing for selecting sequence #6.



It is recommended when changing sequences that the Sequence Select outputs be used to verify that the sequence has been changed before issuing a start signal. Delay from Sequence Select input to Sequence Select output is approx. 5ms.

## Output signals from the SAN Servo Controllers

The output signals listed below are signals available from the individual spindle controller (SAN) Unit and only indicate status from that particular spindle. They do not indicate status from any other spindle or group of spindles. These are typically used for individual spindle status display. The number in the tables below are only for reference showing total number of signals available per spindle. (Total number of available signals from the SAN Units: 31 Spindles X 28 Signals = 868 signals)

AFC1500 SAN Servo Controller Output Signals		
1	REJ	Reject
2	ACC	Accept
3	ABN	Abnormal
4	BYP	In Bypass
5	RDY	Ready
6	BUSY	Busy
7	P SEL 1	Parameter Select 1 bit
8	P SEL 2	Parameter Select 2 bit
9	P SEL 3	Parameter Select 3 bit
10	P SEL 4	Parameter Select 4 bit
11	TM1 LO	Time 1 Reject Low
12	TM1 HI	Time 1 Reject High
13	TM2 LO	Time 2 Reject Low
14	TM2 HI	Time 2 Reject High
15	FT LO	Final Torque Low Reject
16	FT HI	Final Torque High Reject
17	PT LO	Peak Torque Low Reject
18	PT HI	Peak Torque High Reject
19	AN LO	Angle Low Reject
20	AN HI	Angle High Reject
21	TR1 LO	Torque Rate 1 Low Reject
22	TR1 HI	Torque Rate 1 High Reject
23	TR2 LO	Torque Rate 2 Low Reject
24	TR2 HI	Torque Rate 2 High Reject
25	TR3 LO	Torque Rate 3 Low Reject
26	TR3 HI	Torque Rate 3 High Reject
27	AMP LO	Current Warning Low
28	AMP HI	Current Warning High

## Typical I/O Layout (Fieldbus)

The following I/O layout map is provided as a typical reference of the bit addressing for FIELDBUS systems. This is only a reference and NOT intended for any particular application or fieldbus type. See your application's Electrical Control Schematic drawings for your actual I/O layout.

Note: The inputs are permanently set in the location shown and cannot be changed. However, the Output locations are programmable and may not reside in the locations shown.

### Inputs

Bit	Input	Bit	Input	Bit	Input
1	Stop	33	Spindle Bypass 11	65	Not Used
2	Reset	34	Spindle Bypass 12	66	Not Used
3	Reverse	35	Spindle Bypass 13	67	Not Used
4	Start	36	Spindle Bypass 14	68	Not Used
5	Seq. Select 0	37	Spindle Bypass 15	69	Not Used
6	Seq. Select 1	38	Spindle Bypass 16	70	Not Used
7	Seq. Select 2	39	Spindle Bypass 17	71	Not Used
8	Seq. Select 3	40	Spindle Bypass 18	72	Not Used
9	Cycle Count - Up	41	Spindle Bypass 19	73	Not Used
10	Cyc. Count Reset	42	Spindle Bypass 20	74	Not Used
11	Not Used	43	Spindle Bypass 21	75	Not Used
12	Not Used	44	Spindle Bypass 22	76	Not Used
13	Input Port 0	45	Spindle Bypass 23	77	Not Used
14	Input Port 1	46	Spindle Bypass 24	78	Not Used
15	Input Port 2	47	Spindle Bypass 25	79	Not Used
16	Input Port 3	48	Spindle Bypass 26	80	Not Used
17	Spindle Bypass 1	49	Spindle Bypass 27	81	Not Used
18	Spindle Bypass 2	50	Spindle Bypass 28	82	Not Used
19	Spindle Bypass 3	51	Spindle Bypass 29	83	Not Used
20	Spindle Bypass 4	52	Spindle Bypass 30	84	Not Used
21	Spindle Bypass 5	53	Spindle Bypass 31	85	Not Used
22	Spindle Bypass 6	54	Not Used	86	Not Used
23	Spindle Bypass 7	55	Not Used	87	Not Used
24	Spindle Bypass 8	56	Not Used	88	Not Used
25	Spindle Bypass 9	57	Not Used	89	Not Used
26	Spindle Bypass 10	58	Not Used	90	Not Used
27	Not Used	59	Not Used	91	Not Used
28	Not Used	60	Not Used	92	Not Used
29	Not Used	61	Not Used	93	Not Used
30	Data Sel. 0 (N/A)	62	Not Used	94	Not Used
31	Data Sel. 1 (N/A)	63	Not Used	95	Not Used
32	Data Sel. 2 (N/A)	64	Not Used	96*	Not Used

\*Note: The number of data bits reserved for inputs varies with the type of fieldbus interface. It varies between 16 & 256 (or more), even though the number of inputs are limited to this list. See your applications Electrical Drawings for this information.

## Outputs

Bit	Output	Bit	Output	Bit	Output
1	Reject (Total)	49	Spdl. 10 Reject	97	Spdl. 22 Reject
2	Accept (Total)	50	Spdl. 10 Accept	98	Spdl. 22 Accept
3	Abnormal	51	Spdl. 10 Abnormal	99	Spdl. 22 Abnormal
4	Ready	52	Spdl. 10 Bypassed	100	Spdl. 22 Bypassed
5	Busy	53	Spdl. 11 Reject	101	Spdl. 23 Reject
6	End	54	Spdl. 11 Accept	102	Spdl. 23 Accept
7	Seq. 0 Selected	55	Spdl. 11 Abnormal	103	Spdl. 23 Abnormal
8	Seq. 1 Selected	56	Spdl. 11 Bypassed	104	Spdl. 23 Bypassed
9	Seq. 2 Selected	57	Spdl. 12 Reject	105	Spdl. 24 Reject
10	Seq. 3 Selected	58	Spdl. 12 Accept	106	Spdl. 24 Accept
11	Spdl. in Bypass	59	Spdl. 12 Abnormal	107	Spdl. 24 Abnormal
12	Current Warning	60	Spdl. 12 Bypassed	108	Spdl. 24 Bypassed
13	Spdl. 1 Reject	61	Spdl. 13 Reject	109	Spdl. 25 Reject
14	Spdl. 1 Accept	62	Spdl. 13 Accept	110	Spdl. 25 Accept
15	Spdl. 1 Abnormal	63	Spdl. 13 Abnormal	111	Spdl. 25 Abnormal
16	Spdl. 1 Bypassed	64	Spdl. 13 Bypassed	112	Spdl. 25 Bypassed
17	Spdl. 2 Reject	65	Spdl. 14 Reject	113	Spdl. 26 Reject
18	Spdl. 2 Accept	66	Spdl. 14 Accept	114	Spdl. 26 Accept
19	Spdl. 2 Abnormal	67	Spdl. 14 Abnormal	115	Spdl. 26 Abnormal
20	Spdl. 2 Bypassed	68	Spdl. 14 Bypassed	116	Spdl. 26 Bypassed
21	Spdl. 3 Reject	69	Spdl. 15 Reject	117	Spdl. 27 Reject
22	Spdl. 3 Accept	70	Spdl. 15 Accept	118	Spdl. 27 Accept
23	Spdl. 3 Abnormal	71	Spdl. 15 Abnormal	119	Spdl. 27 Abnormal
24	Spdl. 3 Bypassed	72	Spdl. 15 Bypassed	120	Spdl. 27 Bypassed
25	Spdl. 4 Reject	73	Spdl. 16 Reject	121	Spdl. 28 Reject
26	Spdl. 4 Accept	74	Spdl. 16 Accept	122	Spdl. 28 Accept
27	Spdl. 4 Abnormal	75	Spdl. 16 Abnormal	123	Spdl. 28 Abnormal
28	Spdl. 4 Bypassed	76	Spdl. 16 Bypassed	124	Spdl. 28 Bypassed
29	Spdl. 5 Reject	77	Spdl. 17 Reject	125	Spdl. 29 Reject
30	Spdl. 5 Accept	78	Spdl. 17 Accept	126	Spdl. 29 Accept
31	Spdl. 5 Abnormal	79	Spdl. 17 Abnormal	127	Spdl. 29 Abnormal
32	Spdl. 5 Bypassed	80	Spdl. 17 Bypassed	128	Spdl. 29 Bypassed
33	Spdl. 6 Reject	81	Spdl. 18 Reject	129	Spdl. 30 Reject
34	Spdl. 6 Accept	82	Spdl. 18 Accept	130	Spdl. 30 Accept
35	Spdl. 6 Abnormal	83	Spdl. 18 Abnormal	131	Spdl. 30 Abnormal
36	Spdl. 6 Bypassed	84	Spdl. 18 Bypassed	132	Spdl. 30 Bypassed
37	Spdl. 7 Reject	85	Spdl. 19 Reject	133	Spdl. 31 Reject
38	Spdl. 7 Accept	86	Spdl. 19 Accept	134	Spdl. 31 Accept
39	Spdl. 7 Abnormal	87	Spdl. 19 Abnormal	135	Spdl. 31 Abnormal
40	Spdl. 7 Bypassed	88	Spdl. 19 Bypassed	136	Spdl. 31 Bypassed
41	Spdl. 8 Reject	89	Spdl. 20 Reject	137	Spare
42	Spdl. 8 Accept	90	Spdl. 20 Accept	138	Spare
43	Spdl. 8 Abnormal	91	Spdl. 20 Abnormal	139	Spare
44	Spdl. 8 Bypassed	92	Spdl. 20 Bypassed	140	Spare
45	Spdl. 9 Reject	93	Spdl. 21 Reject	141	Spare
46	Spdl. 9 Accept	94	Spdl. 21 Accept	142	Spare
47	Spdl. 9 Abnormal	95	Spdl. 21 Abnormal	143	Spare
48	Spdl. 9 Bypassed	96	Spdl. 21 Bypassed	144	Spare

Note: These outputs are programmable & may not reflect this layout in your application.

## Abnormal Code

The Multi Unit is capable of giving unit fault status to the AFC 1500 User Console in the form of a code number. This number can be read and displayed by the User Console software. (See the User Console manual for more information where to access this function) These codes are only available on Multi Firmware version 3.34 or later.

Abnormal Number	Description
1	An Axis unit was not in Ready status when the Multi Unit attempted to start - confirm all axis status
2	The connected spindles do not match with spindles called from fastening sequence - confirm fastening sequence
3	Fastening sequence does not have spindle numbers assigned - confirm fastening sequence
4	Fastening sequence selected does not exist - confirm fastening sequence.
5	No End command in the fastening sequence
6	Fastening sequence abnormal
7	An Axis unit was not in Ready status when the Multi Unit attempted to send 1st step command - confirm all axis status
8	An Axis unit was not in Ready status when the Multi Unit attempted to send 2nd step command - confirm all axis status
9	Input / Output port number error - input port number over 4 or Output port number over 8 is set